Product Service Manual – Level II



Service Manual for BenQ:
G2420HD

P/N: 9H.L3ALB.QBx

Applicable for All Regions

Version: 001
Date:2009/05/26

Notice:
- For RO to input specific "Legal Requirement" in specific NS regarding to responsibility and liability statements.

- Please check BenQ's eSupport web site, http://esupport.benq.com, to ensure that you have the most recent version of this manual.

First Edition (May, 2009)

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Abbreviations & Acronyms

1 About This Manual

This manual contains information about maintenance and service of BenQ products. Use this manual to perform diagnostics tests, troubleshoot problems, and align the BenQ product.

1.1. Trademark

The following terms are trademarks of BenQ Corporation:

BenQ

Importance

Only trained service personnel who are familiar with this BenQ Product shall perform service or maintenance to it. Before performing any maintenance or service, the engineer MUST read the "Safety Note".

2 Introduction

This section contains general service information, please read through carefully. It should be stored for easy access place for quick reference.

2.1. RoHS (2002/95/EC) Requirements

– Applied to all countries require RoHS.

The RoHS (Restriction of Hazardous Substance in Electrical and Electronic Equipment Directive) is a legal requirement by EU (European Union) for the global electronics industry which sold in EU and some counties also require this requirement. Any electrical and electronics products launched in the market after June 2006 should meet this RoHS requirements. Products launched in the market before June 2006 are not required to compliant with RoHS parts. If the original parts are not RoHS complaints, the replacement parts can be non ROHS complaints, but if the original parts are RoHS compliant, the replacement parts MUST be RoHS complaints.
If the product service or maintenance require replacing any parts, please confirming the RoHS requirement before replace them.

2.2. Safety Notice

1. Make sure your working environment is dry and clean, and meets all government safety requirements.
2. Ensure that other persons are safe while you are servicing the product. DO NOT perform any action that may cause a hazard to the customer or make the product unsafe.
3. Use proper safety devices to ensure your personal safety.
4. Always use approved tools and test equipment for servicing.
5. Never assume the product's power is disconnected from the mains power supply. Check that it is disconnected before opening the product's cabinet.
6. Modules containing electrical components are sensitive to electrostatic discharge (ESD). Follow ESD safety procedures while handling these parts.
7. Some products contain more than one battery. Do not disassemble any battery, or expose it to high temperatures such as throwing into fire, or it may explode.
8. Refer to government requirements for battery recycling or disposal.

2.3. Compliance Statement

Caution: This Optical Storage Product contains a Laser device. Refer to the product specifications and your local Laser Safety Compliance Requirements.

2.4. General Descriptions

This Service Manual contains general information. There are 3 levels of service:

Level 1: Cosmetic / Appearance / Alignment Service
Level 2: Circuit Board or Standard Parts Replacement
Level 3: Component Repair to Circuit Boards

2.5. Related Service Information

BenQ Global Service Website: http://www.benq.com/support/
eSupport Website: http://esupport.benq.com/v2

3 Product Overview

3.1. Specification

3.1.1 Introduction

G2420HD is defined 24'W LCD Monitor supports WXGA (1920x1080) resolution with DPMS (Display Power Management System) and Senseye function. There are three different input types, D-sub, DVI and HDMI, of models. G2420HD adopts AUO panel, M240HW01 V2.

The features summary is shown as below,

*All panel spec. in service manual definition depends on the variance of panel source.

*All spec. of monitor need to warm up at least 1hr.

* To test the "Contrast Ratio" and "Luminance" functions, the color status must be "User preset" mode.

1. "Contrast Ratio": Set "brightness" at 100, and "contrast" at 50.
2. "Luminance": Set "brightness" at 100, and "contrast" at 100.

Feature items	Specifications	Remark
Panel supplier & module name	AUO M240HW01 V2	TN, Normally white
Screen diagonal	24W"	609.7mm
Display Format	531.36(H) x 298.89(V)	Panel Display information
Pixel Pitch	0.276 mm x 0.276 mm	per one triad
Viewing Angle (@ Contrast Ratio >= 10)	R/L:85/85 degrees (typ) and U/D: 80/80 degrees (typ)	
Analog interface with Scaling supported	Yes	With 15-pin D-sub connector
DVI interface with Scaling supported	Yes	
HDMI interface with Scaling supported	Yes	
Max resolution mode supported	1920 (H) x 1080(V)@60Hz	
Number of Display Colors supported	16.7 Millions	RGB 6-bit + FRC
Contrast Ratio	1000:1 (typ.),600:1(min)	Test Condition: Set Contrast at 50, Brightness at 100, Color at User preset
Luminance	300 cd/m^2 (typ.),240 cd/m^2 (min)	Test Condition: Set contrast at 100, brightness at 100 , color at User preset.
AC power input	Yes	90-264 Volts, 47-63 Hz.
DC power input (with AC power adapter)	No	
DPMS supported(G2420HD)	Yes	Off mode<1W Sleep Mode <1W
LED indicator for power status showed	Yes	Green/Amber/None
OSD for control & information supported	Yes	
Multi-language supported for OSD	Yes	17 languages.
Buttons control supported	Yes	
Flywheel control supported	No	
Scaling function supported	Yes	

Auto adjustment function supported	Yes	"I-Key" function
DDC function supported (EDID ver. 1.3)	Yes	DDC2B
DDC-CI support version 1.1 or later	Yes	DDC-CI
Audio speakers supported	No	
Audio Jack (input connector) supported	No	
Earphone Jack (input connector) supported	Yes	For HDMI Audio only
Microphone function supported	No	
Mechanical Tilt base design	Yes	From -5 to +23 degree
VESA wall mounting design	Yes	
Mechanical Rotate design	No	
Mechanical Lift base design	No	
Kensington compatible lock design	Yes	

3.1.2 Operational Specification

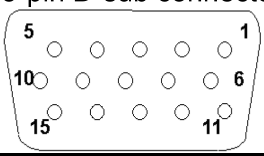
3.1.2.1 Power supply

Item	Condition	Spec	OK	N.A	Remark
Input Voltage range	Universal input full range	90~264VAC /47~63Hz	√		
Input Current range	90 ~ 264VAC	≤ 2.0 Arms	√		
Power Consumption	Normal "On" operation	**<49** W	√		LED: Green
DPMS(G2420HD)	DPMS "Off" state DPMS "Sleep" state	< 1 W < 1 W	√		LED: Off LED: Amber
Inrush Current	110 VAC 220 VAC	**< 30 A (peak)** **< 60A (peak)**	√		Cold-start
Earth Leakage Current	264 VAC/50Hz	< 3.5 mA	√		
Hi-Pot	1. 1500VAC, 1 sec 2. Ground test: 30A, 1sec	Without damage < 0.1 ohm	√		(on-line test) (in-lab test)
Power Line Transient	IEC1000-4-4	1KV	√		
	IEC1000-4-5 (Surge)	Common: 2KV, Differential: 1KV	√		
CCFL operation range	90 ~ 264VAC	3~8mA	√		Depends on panel source
CCFL Frequency	90 ~ 264VAC	40KHz ~ 80KHz	√		Depends on panel source
Power cord		Color: Black Length: 1500 +/- 50 mm	√		

3.1.2.2 Signal interface

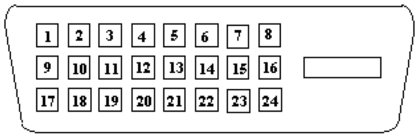
Item	Condition	Spec	OK	N.A	Remark
Signal Cable	15-pin D-Sub	Color: Black Length: 1500 +/- 30 mm	√		
	24-pin DVI-D	Color: Black Length: 2000 +/- 50 mm	√		
Pin assignment	15-pin D-sub connector	See Note-1	√		For 15-pin D-sub
	24-pin DVI-D connector	See Note-2	√		For 24-pin DVI-D
	19-pin HDMI connector	See Note-3	√		For 19-pin HDMI
Analog input	Signal type	Separate analog R/G/B	√		For 15-pin D-sub
	Level	700 mV (peak to peak)	√		
	Impedance	75 Ohms +/- 1.5 Ohms	√		
Sync input	Signal type	Separate H/V-sync Composite H/V-sync (Positive/Negative)	√		For 15-pin D-sub
	Level	Logic High: 2.4V ~ 5.5V Logic Low: 0V ~ 0.5V (TTL level)	√		Refer to VESA VSIS Standard V1R1
	Impedance	Minimum 2.2KΩ(pull down)	√		10KΩ for application
	Sync Pulse Width (SPW)	0.7μs < H-SPW 1H < V-SPW	√		
Digital input	Level	600mV for each differential line	√		
	Impedance	50 Ohm TDR Scan needed for DVI cable and interface board	√		

Note-1: The pin assignment of 15-pin D-sub connector is as below,



P	Signal Assignment	Pin	Signal Assignment
1	Red video	9	PC5V (+5 volt power)
2	Green video	10	Sync Ground
3	Blue video	11	Ground
4	Ground	12	SDA
5	Cable Detected	13	H-Sync (or H+V)
6	Red Ground	14	V-sync
7	Green Ground	15	SCL
8	Blue Ground		

Note-2: The pin assignment of 24-pin DVI-D connector is as below,



Pin	Signal Assignment	Pin	Signal Assignment
1	TMDS RX2-	13	Floating
2	TMDS RX2+	14	+5V Power
3	TMDS Ground	15	Ground
4	Floating	16	Hot Plug Detect
5	Floating	17	TMDS RX0-
6	DDC Clock	18	TMDS RX0+
7	DDC Data	19	TMDS Ground
8	Floating	20	Floating
9	TMDS RX1-	21	Floating
10	TMDS RX1+	22	TMDS Ground
11	TMDS Ground	23	TMDS Clock+
12	Floating	24	TMDS Clock-

Note-3: The pin assignment of 19-pin HDMI connector is as below,



Table 4-8 Type A-to-Type A Cable Wire Assignment

Type A pin	Signal Name	Wire	Type A pin
1	TMDS Data2+	A	1
2	TMDS Data2 Shield	B	2
3	TMDS Data2–	A	3
4	TMDS Data1+	A	4
5	TMDS Data1 Shield	B	5
6	TMDS Data1–	A	6
7	TMDS Data0+	A	7
8	TMDS Data0 Shield	B	8
9	TMDS Data0–	A	9
10	TMDS Clock+	A	10
11	TMDS Clock Shield	B	11
12	TMDS Clock–	A	12
13	CEC	C	13
14	Reserved (in cable but N.C. on device)	C	14
15	SCL	C	15
16	SDA	C	16
17	DDC/CEC Ground	D	17
18	+5V Power	5V	18
19	Hot Plug Detect	C	19

3.1.2.3 Video performance

Item	Condition	Spec	OK	N.A	Remark
Max. support Pixel rate		170 MHz	√		Both for analog and digital inputs
Max. Resolution		1920x1080@60	√		Both for analog and digital inputs
Rise time + Fall time		<5.89 ns (50% of minimum pixel clock period)	√		1920 x 1080 @ 60Hz (max. support timing)
Settling Time after overshoot /undershoot		< 5% final full-scale value	√		Refer to VESA VSIS Standard V1R1
Overshoot/Undershoot		< 12% of step function voltage level over the full voltage range	√		Refer to VESA VSIS Standard V1R1

3.1.2.4 Scan range

Item	Condition	Spec	OK	N.A	Remark
Horizontal		24-83 KHz	√		
Vertical		50-76 Hz	√		

3.1.2.5 Plug & Play DDC2B DDC-CI Support

Item	Condition	Spec	OK	N.A	Remark
DDC channel type		DDC2B	√		
EDID		Version 1.3	√		Refer to BenQ LS EDID definition.
DDC-CI		Version 1.1 or Later	√		Refer to BenQ DDCCI requirement definition.

3.1.2.6 Support Timings

BenQ Preferred Mode Number	24W 1920x1080	Resolution	Pixel clock (unit:MHz)	H-sync (unit:KHz)	V-sync (unit:Hz)	H-Pol	V-Pol	H-sync H-total (unit:pixel)	H-sync Display (unit:pixel)	H-sync Back-porch (unit:pixel)	H-sync Pulse-width	H-sync Front-porch (unit:pixel)	H-sync Border (unit:pixel)	V-sync V-total (unit:line)	V-sync Display (unit:line)	V-sync Back-porch (unit:line)	V-sync Pulse-width	V-sync Front-porch (unit:line)	V-sync Border (unit:line)
IDF-1	P	640x350	25.18	31.47	70.09	P	N	800	640	48	96	16	0	449	350	59	2	38	0
	FS	640x350	31.50	37.86	85.08	P	N	832	640	96	64	32	0	445	350	60	3	32	0
	NP	640x400	25.18	31.47	70.09	N	P	800	640	48	96	16	0	449	400	35	2	12	0
	FS	640x400	31.5	37.86	85.08	N	P	832	640	96	64	32	0	445	400	41	3	1	0
	NP	640x480	30.24	35.00	66.67	N	N	864	640	96	64	64	0	525	480	39	3	3	0
DMT-1	P	640x480	25.17	31.47	59.94	N	N	800	640	40(/48)	96	8(/16)	16(/0)	525	480	25(/33)	2	2(/10)	16(/0)
	NP	640x480	31.50	37.86	72.81	N	N	832	640	120(/128)	40	16(/24)	16(/0)	520	480	20(/28)	3	1(/9)	16(/0)
DMT-2	P	640x480	31.50	37.50	75.00	N	N	840	640	120	64	16	0	500	480	16	3	1	0
DMT-3	FS	640x480	36.00	43.27	85.01	N	N	832	640	80	56	56	0	509	480	25	3	1	0
	NP	640x500	25.25	31.00	57.76	N	N	816	640	80	32	48	0	537	500	6	10	3	0
IDF-2	P	720x400	28.32	31.47	70.08	N	P	900	720	45	108	18	9	449	400	27	2	13	7
	FS	720x400	35.5	37.93	85.04	N	P	936	720	108	72	36	0	446	400	42	3	1	0
	P	832x624	57.27	49.71	74.53	N	N	1152	832	224	64	32	0	667	624	39	3	1	0
	NP	800x600	36.00	35.16	56.25	P	P	1024	800	128	72	24	0	625	600	22	2	1	0
DMT-4	P	800x600	40.00	37.88	60.32	P	P	1056	800	88	128	40	0	628	600	23	4	1	0
	NP	800x600	50.00	48.08	72.19	P	P	1040	800	64	120	56	0	666	600	23	6	37	0
DMT-5	P	800x600	49.50	46.88	75.00	P	P	1056	800	160	80	16	0	625	600	21	3	1	0
DMT-6	FS	800x600	56.25	53.67	85.06	P	P	1048	800	152	64	32	0	631	600	27	3	1	0
DMT-26	NP	848x480	33.75	31.02	60.00	P	P	1088	848	112	112	16	0	517	480	23	8	6	0
	NP	848x480	31.50	29.83	59.66	N	P	1056	848	104	80	24	0	500	480	12	5	3	0
	NP	848x480	37.52	35.00	70.00	N	P	1072	848	112	88	24	0	500	480	16	3	1	0
	NP	848x480	39.25	36.07	72.00	N	P	1088	848	120	88	32	0	501	480	17	3	1	0
	NP	848x480	41.00	37.68	74.77	N	P	1088	848	120	80	40	0	504	480	16	5	3	0
	NP	720x576	32.71	35.910	59.950	N	P	912	720	96	72	24	0	599	576	13	7	3	0
DMT-7	P	1024x768	65.00	48.36	60.00	N	N	1344	1024	160	136	24	0	806	768	29	6	3	0
	NP	1024x768	75.00	56.48	70.07	N	N	1328	1024	144	136	24	0	806	768	29	6	3	0
	NP	1024x768	78.43	57.67	72.00	N	P	1360	1024	168	112	56	0	801	768	29	3	1	0
	P	1024x768	80.00	60.24	74.93	N	N	1328	1024	176	96	32	0	804	768	30	3	3	0
DMT-8	P	1024x768	78.75	60.02	75.03	P	P	1312	1024	176	96	16	0	800	768	28	3	1	0
DMT-9	FS	1024x768	94.50	68.68	85.00	P	P	1376	1024	208	96	48	0	808	768	36	3	1	0
DTV	P	1152x720	66.75	44.86	60	N	P	1488	1152	168	112	56	0	748	720	19	6	3	0
	NP	1152x864	94.50	63.85	70.01	P	P	1480	1152	200	96	32	0	912	864	44	3	1	0
DMT-10	P	1152x864	108.00	67.50	75.00	P	P	1600	1152	256	128	64	0	900	864	32	3	1	0
GTF-7	NP	1152x864	119.651	77.09	85.00	N	P	1552	1152	200	120	80	0	910	864	39	4	3	0
	P	1152x870	100.00	68.68	75.06	N	N	1456	1152	144	128	32	0	915	870	39	3	3	0
	P	1152x900	92.94	61.80	65.95	N	N	1504	1152	192	128	32	0	937	900	31	4	2	0
	NP	1152x900	105.59	71.73	76.07	N	N	1472	1152	208	96	16	0	943	900	33	8	2	0
	P	1280x720	74.25	45.00	59.94	N	P	1650	1280	260	40	70	0	750	720	20	5	5	0
CVT-7	P	1280x720	74.50	44.77	59.86	N	P	1664	1280	192	128	64	0	748	720	20	5	3	0
	P	1280x720	95.75	56.46	74.78	N	P	1696	1280	208	128	80	0	755	720	27	5	3	0
	P	1280x768-R	68.25	47.40	60.00	P	N	1440	1280	80	32	48	0	790	768	12	7	3	0
DMT-20	P	1280x768	79.50	47.78	59.87	N	P	1664	1280	192	128	64	0	798	768	20	7	3	0
	NP	1280x768	102.25	60.29	74.89	N	P	1696	1280	208	128	80	0	805	768	27	7	3	0
	FS	1280x768	117.50	68.63	84.84	N	P	1712	1280	216	136	80	0	809	768	31	7	3	0
	NP	1280x800	71	49.31	59.91	P	P	1440	1280	80	32	48	0	823	800	15	6	2	0
CVT-8	P	1280x800	83.50	49.702	59.81	N	P	1680	1280	200	128	72	0	831	800	22	6	4	0
	NP	1280x800	88.25	58.3	70	N	P	1696	1280	208	136	72	0	833	800	29	3	1	0
	NP	1280x800	102.8	60.048	72	N	P	1712	1280	216	136	80	0	834	800	30	3	1	0
	P	1280x800	106.6	62.795	74.934	N	P	1696	1280	208	128	80	0	838	800	29	6	3	0
	NP	1280x800	122.5	71.55	84.88	N	P	1712	1280	216	136	80	0	843	800	34	6	3	0
	P	1280x960	108.00	60.00	60.00	P	P	1800	1280	312	112	96	0	1000	960	36	3	1	0
	P	1280x960	148.50	85.94	85.00	P	P	1728	1280	224	160	64	0	1011	960	47	3	1	0
DMT-11	P	1280x1024	108.00	63.98	60.02	P	P	1688	1280	248	112	48	0	1066	1024	38	3	1	0
	NP	1280x1024	126.99	74.88	69.85	P	P	1696	1280	224	160	32	0	1072	1024	42	4	2	0
	NP	1280x1024	124.90	74.40	70.00	N	N	1678	1280	216	112	70	0	1064	1024	34	5	1	0
	NP	1280x1024	134.60	77.90	72.00	P	P	1728	1280	224	136	88	0	1082	1024	52	5	1	0
DMT-12	P	1280x1024	135.00	79.98	75.02	P	P	1688	1280	248	144	16	0	1066	1024	38	3	1	0
	NP	1280x1024	135.09	81.18	76.16	N	N	1664	1280	288	64	32	0	1066	1024	32	8	2	0
DMT-13	FS	1280x1024	157.50	91.15	85.02	P	P	1728	1280	224	160	64	0	1072	1024	44	3	1	0
DMT-21	P	1360x768	85.50	47.71	60.01	P	P	1792	1360	256	112	64	0	795	768	18	6	3	0
	P	1366x768	85.50	47.71	59.79	P	P	1792	1366	213	143	70	0	798	768	24	3	3	0
	NP	1400x1050-R	101.00	64.74	59.95	P	N	1560	1400	80	32	48	0	1080	1050	23	4	3	0
DMT-18	NP	1400x1050	121.75	65.32	59.98	N	P	1864	1400	232	144	88	0	1089	1050	32	4	3	0
	NP	1400x1050	156.00	82.28	74.87	N	P	1896	1400	248	144	104	0	1099	1050	42	4	3	0
	NP	1400x1050	179.50	93.88	84.96	N	P	1912	1400	256	152	104	0	1105	1050	48	4	3	0
DMT-25	P	1440x900-R	88.75	55.496	59.901	P	N	1600	1440	80	32	48	0	926	900	17	6	3	0
DMT-25	P	1440x900	106.5	55.935	59.887	N	P	1904	1440	232	152	80	0	934	900	25	6	3	0
	P	1440x900	136.75	70.6	75	N	P	1936	1440	248	152	96	0	942	900	33	6	3	0
	P	1600X900	97.75	59.75	55.54	P	N	1760	1600	80	32	48	0	926	900	18	5	3	0
	P	1600x1000-R	108.5	61.648	59.910	P	N	1760	1600	80	32	48	0	1029	1000	20	6	3	0
CVT-10	NP	1600x1000	132.25	62.14	59.87	N	P	2128	1600	264	168	96	0	1038	1000	29	6	3	0
	NP	1600x1000	169.25	78.356	74.83	N	P	2160	1600	280	168	112	0	1047	1000	38	6	3	0
CVT-2	NP	1600x1200-R	130.25	74.01	59.92	P	N	1760	1600	80	32	48	0	1235	1200	28	4	3	0
DMT-14	P	1600x1200	162.00	75.00	60.00	P	P	2160	1600	304	192	64	0	1250	1200	46	3	1	0
	NP	1600x1200	175.50	81.25	65.00	P	P	2160	1600	304	192	64	0	1250	1200	46	3	1	0
	NP	1600x1200	189.00	87.50	70.00	P	P	2160	1600	304	192	64	0	1250	1200	46	3	1	0
DMT-15	NP	1600x1200	202.50	93.75	75.00	P	P	2160	1600	304	192	64	0	1250	1200	46	3	1	0
DMT-16	O	1600x1200	229.50	106.25	85.00	P	P	2160	1600	304	192	64	0	1250	1200	46	3	1	0
DMT-22	NP	1680x1050-R	119.00	64.67	59.88	P	N	1840	1680	80	32	48	0	1080	1050	21	6	3	0
DMT-23	P	1680x1050	146.25	65.29	59.95	N	P	2240	1680	280	176	104	0	1089	1050	30	6	3	0
	P	1680x1050	187	82.306	75	N	P	2272	1680	296	176	120	0	1099	1050	40	6	3	0
CVT2.04M	NP	1600x1280	171.75	79.5	59.9	N	P	2160	1600	280	168	112	0	1327	1280	37	7	3	0
CVT2.41M3	FS	1792X1344	203.25	83.57	59.9	N	P	2432	1792	320	192	128	0	1393	1344	42	4	3	0
CVT2.41M3	O	1792X1344	257.75	105.290	75.00	N	P	2448	1792	328	192	136	0	1405	1344	54	4	3	0
CVT2.58M3	O	1856X1392	217.25	86.485	59.934	N	P	2512	1856	328	200	128	0	1443	1392	44	4	3	0
CVT2.58M3	O	1856X1392	277.5	109	74.918	N	P	2544	1856	344	200	144	0	1456	1392	57	4	3	0
CVT2.59M4	O	1800x1440	218.25	89.4	59.9	N	P	2440	1800	320	192	128	0	1493	1440	43	7	3	0
	P	1920x1080-R	138.5	66.587	59.934	P	N	2080	1920	80	32	48	0	1111	1080	23	5	3	0
	P	1920x1080	173	67.158	59.963	N	P	2576	1920	328	200	128	0	1120	1080	32	5	3	0
DMT	P	1920x1080	148.5	67.5	60	P	P	2200	1920	148	44	88	0	1125	1080	36	5	4	0
	FS	1920X1200-R5	127.750	61.418	49.974	P	N	2080	1920	80	32	48	0	1229	1200	20	6	3	0
CVT2.30MA-R	FS	1920X1200-R	154.00	74.04	59.95	P	N	2080	1920	80	32	48	0	1235	1200	26	6	3	0
	FS	1920X1200	193.25	74.56	59.89	N	P	2592	1920	336	200	136	0	1245	1200	36	6	3	0
	O	1920X1200	245.25	94.04	74.93	N	P	2608	1920	344	208	136	0	1255	1200	46	6	3	0

HDMI video support timing

Video Timing	VGA	DVI	HDMI	Resolution	Pixel clock (unit:MHz)	H-sync (unit:KHz)	V-sync (unit:Hz)	H-Pol	V-Pol	H-sync H-total (unit:pixel)	Display (unit:pixel)	Back-porch (unit:pixel)	Pulse-width (unit:pixel)	Front-porch (unit:pixel)	Border (unit:pixel)	V-sync V-total (unit:line)	Display (unit:line)	Back-porch (unit:line)	Pulse-width (unit:line)	Front-porch (unit:line)	Border (unit:line)
SD	Y	Y	Y	480i	13.5	15.734	60	X	X	858	720	57	62	19	0	525	480	38	4	3	0
SD	Y	Y	Y	576i	13.5	15.625	50	X	X	864	720	69	63	12	0	625	576	44	2	3	0
HD	Y	Y	Y	640x480p	25.175	31.468	59.94	X	X	800	640	48	96	16	0	525	480	30	9	6	0
HD	Y	Y	Y	720x480p	27.00	31.468	59.94	X	X	858	720	60	62	16	0	525	480	30	9	6	0
HD	Y	Y	Y	720x576p	27.00	31.25	50	X	X	864	720	68	64	12	0	625	576	39	5	5	0
HD	Y	Y	Y	720p 50Hz	74.25	37.50	50	X	X	1980	1280	220	40	440	0	750	720	20	5	5	0
HD	Y	Y	Y	720p 60Hz	74.25	45.00	60	X	X	1650	1280	220	40	110	0	750	720	20	5	5	0
HD	Y	Y	Y	1080i 50Hz	74.25	28.125	50	X	X	2640	1920	148	44	528	0	1125	1080	38	5	2	0
HD	Y	Y	Y	1080i 50Hz	74.25	31.25	50	X	X	2304	1920	184	168	32	0	1250	1080	116	44	10	0
HD	Y	Y	Y	1080i 60Hz	74.25	33.75	60	X	X	2200	1920	148	44	88	0	1125	1080	38	5	2	0
HD	N	N	N	1080p 24Hz	74.25	27	24	X	X	2750	1920	148	44	638	0	1125	1080	38	5	2	0
HD	N	N	N	1080p 25Hz	74.25	28.125	25	X	X	2640	1920	148	44	528	0	1125	1080	38	5	2	0
HD	N	N	n	1080p 30Hz	74.25	33.75	30	X	X	2200	1920	148	44	88	0	1125	1080	38	5	2	0
HD	Y	Y	Y	1080p 50Hz	148.50	56.250	50	X	X	2640	1920	148	44	528	0	1125	1080	38	5	2	0
HD	Y	Y	Y	1080p 60Hz	148.50	67.50	60	X	X	2200	1920	148	44	88	0	1125	1080	38	5	2	0

3.1.3 Operational & Functional Specification

3.1.3.1 Video performance

***All spec. of monitor need to warm up at least 1hr.**

Item	Condition	Spec	OK	NA	Remark
Resolution	Any input resolution modes which are under 1920x1080	1920 x 1080	√		
Contrast ratio		600(min),1000(typ)	√		Test Condition: Set Contrast at 50, Brightness at 100, Color at User preset.
Brightness	At R/G/B saturated condition	240 cd/m^2 (typ.),300(min)	√		Test Condition : Set contrast at 100 , brightness at 100 , color at User preset.
Response time	Gray to Gray	2 ms (typ.)	√		Test Equipment: Westar TRD 100 or equal level equipment ;
Viewing angle	At Contrast ratio = 10	R/L: 85/85 degrees (typ.) 75/75 degrees (min)	√		
	At Contrast ratio = 10	U/D: 80/80 degrees (typ.) 70/70 degress(min)	√		
CIE coordinate of White		(0.31, 0.33) +/- (0.03, 0.03)	√		
Display colors		16.7 Millions colors	√		6 bit+FRC
Response time with AMA	Average response time of gray level to gray level	2ms(typ.), 2.9ms(max)		√	Test Condition: Set Contrast at 50, Brightness at 90, Color at User preset.

3.1.3.2 Brightness Adjustable Range

Item	Condition	Spec	OK	NA	Remark
Brightness adjustable range	At default contrast level (saturate point) & Full-white color pattern	(Max. brightness value – Min. brightness value) ≧ 100 cd/㎡	√		

3.1.3.3 Acoustical Noise

Item	Condition	Spec	OK	NA	Remark
Acoustical Noise	At 4 cm distance	≦ 28 dB/A	√		Refer to C326

3.1.3.4 Environment

Item	Condition	Spec	OK	NA	Remark
Temperature	Operating	0 ~ +40 ℃	√		
	Non-operating	-20 ~ +60 ℃	√		
Humidity	Operating	10 ~ 90%	√		Non-condensing
	Non-operating	10 ~ 90%	√		Non-condensing
Altitude	Operating	0~3048m (10,000ft)	√		Without packing
	Non-operating	0~12,192m (40,000ft)	√		With packing

3.1.3.5 Transportation

Item	Condition	Spec	OK	NA	Remark
(1) Vibration	Package, Non-Operating	(1) Sine wave 5~200Hz 1.5G, 1 octave/min, 15 min dwell on each resonant frequency, all primary axis, one sweep (30 min minimum) per orientation, total of 90+ min.	√		
		(2) Random 5 ~100 Hz, 0 dB/Oct. 0.015 g^2/Hz 100 ~200 Hz, -6 dB/Oct. 200 Hz, 0.0038 g^2/Hz Equivalent to 1.47 Grms, All primary axis, 20 min per- orientation, total is 60 min.			

		(3) Procedure: Confirmed sample with appearance and function ready before testing then compare with after test record as brightness, uniformity and contrast ratio. Perform random vibration after sine-wave vibration test.			
(2) Unpackaged Vibration	Unpackaged, Non-Operating	Test Spectrum: 20 Hz 0.0185(g2/Hz) 200Hz 0.0185(g2/Hz) Duration : 5 Minutes Axis : 3 axis (Horizontal and Vertical axis ,Z axis)	√		
(3) Drop	Package, Non-Operating	91 cm Height (MP stage) (1 corner, 3 edges, 6 faces)	√		
(4) Shock	Wooden package, Non-Operating	Waveform: half sine Faces: 6 sides/ per orientation 3 shocks. Duration: <3ms Velocity accelerate: 75g	√		

3.1.3.6 Electrostatic Discharge Requirements

Item	Condition	Spec	OK	NA	Remark
Electrostatic Discharge	IEC801-2 standard	Contact: 8KV Air: 15KV	√		

3.1.3.7 EMC

Item	Condition	Spec	OK	NA	Remark
TCO03	Electric	Band 1 < 10 V/m Band 2 < 1 V/m	√		
	Magnetic	Band 1 < 200nT Band 2 < 25nT	√		
EMI	FCC part 15J class B EN55022 class B	After Mass production under 1dBuv for constant measure. Besides DNSF and VCCI class-2 are optional.	√		

3.1.3.8 Reliability

Item	Condition	Spec	OK	NA	Remark
MTBF Prediction	Refer to MIL-217F	> 60,000 Hours	√		Excluding CCFL
CCFL Life time	At 25±2℃, under 7.0mA	40,000 Hours (min)	√		See Note-4

Note-4: CCFL lifetime is determined as the time at which brightness of lamp is 50%. The typical lifetime of CCFL is on the condition at 7.0mA lamp current.

3.1.3.9 Audio performance (Ear-Jack, For HDMI audio only)

Item	Condition	Spec	OK	NA	Remark
Preamp + Power amp					
(1)Output power		1 Wrms/CH @ 1KHz		√	
(2)THD (@ 1W)		<1%		√	
(3)S/N ratio		>40dB		√	
Speaker Driver					
(1)Nominal impedance		4 ohm		√	
(2)Rated input power		1 W/CH		√	
(3)Frequency response		180~20KHz SPL-10dB		√	
(4)Output sound pressure level		84 ± 3 dB (1W 0.5M)		√	
(5)Dimension of box		$284x60x27mm^2$		√	
Audio Control					
(1)Volume range		0 ~100 levels	√		
(2)Mute		On/Off	√		

3.1.4 LCD Characteristics

3.1.4.1 The Physical definition & Technology summary of LCD panel

Item	Condition	Spec	OK	N.A	Remark
LCD Panel Supplier		AUO	√		
Panel type of Supplier		M240HW01 V2	√		
Display area	Unit=mm	531.36(H) x 298.89(V)	√		
Physical Size	Unit=mm	556(H) x323.2(V) x 16.65(D)	√		
Weight	Unit=gram	2860(typ.)	√		
Technology		TN type	√		
Pixel pitch	Unit=mm	0.276(H) x 0.276(W) (Typ.)	√		Per one triad
Pixel arrangement		R/G/B vertical stripe	√		
Display mode		Normally White	√		
Support color		16.7Millions colors	√		6 bit + HiFRC

3.1.4.2 Optical characteristics of LCD panel

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	75 75	85 85	- -	
	[degree] [degree]	Vertical (Up) CR = 10 (Down)	70 70	80 80	- -	
Contrast ratio		Normal Direction	600	1000		
Response Time	[msec]	Rising Time	-	3.4	7.4	
	[msec]	Falling Time	-	1.6	2.6	
	[msec]	Rising + Falling	-	5	10	
		Gray to Gray	-	2	-	
Color / Chromaticity Coordinates (CIE)		Red x	0.619	0.649	0.679	
		Red y	0.308	0.338	0.368	
		Green x	0.259	0.289	0.319	
		Green y	0.579	0.609	0.639	
		Blue x	0.116	0.146	0.176	

		Blue y	0.04	0.07	0.10	
Color Coordinates (CIE) White		White x	0.283	0.313	0.343	
		White y	0.299	0.329	0.359	
Luminance Uniformity	[%]	9 points measurement	75	80		
White Luminance @ CCFL 6.0mA (center)	[cd/m^2]		240	300	-	
Crosstalk (in 75Hz)	[%]				1.5	

* The test methods for the above items definition, please refer to the relative panel specification.

3.1.5 User Controls

3.1.5.1 User's hardware control definition

Item	Condition	Spec	OK	NA	Remark
Power button			√		
Enter button			√		
Right/Inc. button			√		
Left/Dec. button			√		
Menu button(Exit buttom)			√		
Mode button				√	
Input Select button				√	
iKey button			√		
Mute button				√	

3.1.5.2 OSD control function definition

Item	Condition	Spec	OK	NA	Remark
Auto Adjust		Auto-Geometry	√		
Brightness			√		
Contrast			√		
Horizontal Position			√		
Vertical Position			√		
Pixel Clock			√		
Phase			√		
Color		Bluish Reddish Normal User: Separate R/G/B adjustment Reset Color	√		
OSD Position		OSD Horizontal position OSD Vertical position	√		
OSD Time		From 5 sec to 30 sec	√		
OSD Lock			√		
Language		17 languages	√		
Recall		Recall All	√		
Mode		Standard / Dynamics / Movie / Photo/sRGB	√		
Input Select		D-sub DVI HDMI	√		

Sharpness			√		
Display Information		For input timing	√		
Volume		For HDMI Audio only	√		
Mute		For HDMI Audio only	√		
Hot key for Brightness			√		
Hot key for Contrast			√		
Hot key for Volume				√	
Hot key for Input Select			√		
Hot key for Mode			√		

The detailed firmware functions' specification, please refer to C212 S/W spec. document.

3.1.6 Mechanical Characteristics

3.1.6.1 Dimension

Item	Condition	Spec	OK	N.A	Remark
Bezel opening		**533.2*300.7 mm**	√		
Monitor without Stand	W x H x D mm	**570*348.42*63.26mm**	√		
Monitor with Stand	W x H x D mm	**570*412.6*183.94mm**	√		
Carton Box (outside)	L x W x H mm	**636*133*482 mm**	√		
Tilt and Swivel range		Tilt: -3.5 ~ +21.5 degree Swivel: 0 degree	√		

3.1.6.2 Weight

Item	Condition	Spec	OK	N.A	Remark
Monitor (Net)		**4.91Kg**	√		
Monitor with packing (Gross)		**6.5Kg**	√		

3.1.6.3 Plastic

Item	Condition	Spec	OK	N.A	Remark
Flammability		**>ABS<,94-HB**	√		
Heat deflection To	**ABS**	65 ℃	√		
UV stability	**ABS**	**Delta E < 8.0**	√		
Resin		MPRII: **ABS** (SD0150/GP35/D150/PA 757/HP-126/T0103)	√		
Texture		**MT-11010**	√		
Color		**BCS-7015A**	√		

3.1.6.4 Carton

Item	Condition	Spec	OK	N.A	Remark
Color		Kraft	√		
Material		A Flute	√		
Compression strength		250 KGF	√		
Burst Strength		19.2 KGF/cm^2	√		
Stacked quantity		5 Layers	√		

3.1.7 Pallet & Shipment

3.1.7.1 Container Specification

Stowing Type	Container	Quantity of products (sets) (Every container)	Quantity of Products (sets) (Every Pallet)	Quantity of pallet (sets) (Every Container)
With pallet	20'	**624**	**Pallet A: 76** **Pallet B: 68** **Pallet C: 24**	**Pallet A: 4** **Pallet B: 4** **Pallet C: 2**
	40'	**1296**	**Pallet A: 76** **Pallet B: 68**	**Pallet A: 9** **Pallet B: 9**
Without pallet	20'		**X**	**X**
			X	**X**
	40'		**X**	**X**
			X	**X**

3.1.7.2 Carton Specification

Product:

Net Weight (Kg)	Gross Weight (Kg)	Dimension w/o Base W*H*D (mm)	Dimension w/ Base W*H*D (mm)
4.9Kg	6.5Kg	**570*412.6*87.7mm**	**570*412.6*183.94mm**

Package:

Carton Interior Dimension (mm) L*W*H	Carton External Dimension (mm) L*W*H
624*121*456 mm	**636*133*482 mm**

3.1.8 Certification

Item	Condition	Spec	OK	N.A	Remark
Environment	Green design	API Doc. 715-C49	√		ISO14000 Requirement
	Blue Angel	German Standard		√	
	E-2000	Switzerland		√	
	EPA	USA Standard	√		
	TCO'99			√	
	TCO'03		√		
	Green Mark		√		
PC-Monitor	Microsoft Windows	PC98/99	√		
	DPMS	VESA	√		
	DDC 2B	Version 1.3	√		
	USB	External		√	
Safety	UL (USA)	UL60950 3rd edition		√	
	CSA (Canada)	CAN/CSA-C22.2 No. 60950	√		
	Nordic / D.N.S.F	EN60950		√	

	FIMKO	EN60950	√		
	CE Mark	73/23/EEC	√		
	CB	IEC60950	√		
	CB	EN60950	√		
	TUV/GS	EN60950 / EK1-ITB 2000:2003	√		
	CCC (China)	CB4943	√		
	GOST	EN60950	√		
	SASO	IEC60950	√		
EMC	CE Mark	89/336/EEC	√		
	FCC (USA)	FCC Part 15 B	√		
	EN55022	Class B	√		
	CISPR 22	Class B	√		
	VCCI (Japan)	VCCI Class B	√		
	BSMI (Taiwan)	CNS 13438	√		
	C-Tick (Australia)	AS/ NZS CISPR22	√		
X- Ray Requirement	DHHS (21 CFR)	USA X- Ray Standard		√	
	DNHW			√	
	PTB	German X- Ray standard		√	
Ergonomics	TUV / Ergo			√	
	ISO 13406-2			√	
	prEN50279			√	

3.2. Customer Acceptance

3.2.1. SCOPE

This document establishes the general workmanship standards and functional Acceptance criteria for LCD color monitor model G2420HD Produced by BenQ Corporation.

3.2.2. PURPOSE

The purpose of this publication is to define a procedure for inspection of the LCD monitor by means of a customer acceptance test, the method of evaluation of defects and rules for specifying acceptance levels.

3.2.3. APPLICATION

The "Customer Acceptance Criteria" is applicable to the inspection of the LCD monitor, completely packed and ready for dispatch to customers. Unless otherwise specified, the customer acceptance inspection should be conducted at manufacturer's site.

3.2.4. DEFINITION

The "Customer Acceptance Criteria" is the document defining the process of examining, testing or otherwise comparing the product with a given set of specified technical, esthetic and workmanship requirements leading to an evaluation of the "degree of fitness for use", including possible personal injury or property damage for the user of the product.

3.2.5. CLASSIFICATION OF DEFECTS

The defects are grouped into the following classes:

Critical defect

A critical defect is a defect that judgment and experience indicate is likely to result in hazardous or unsafe conditions for individuals using, maintaining or depending upon the product.

Major defect

A major defect is a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose.

Minor defect

A minor defect is a defect that is not likely to reduce materially the usability of the product for its intended purpose, or is a departure from established standards having little bearing on the effective use of operation of the product.

3.2.6. CLASSIFICATION OF DEFECTIVES

A defective is a product which contains one or more defects. The defective will be classified into following classes.

Critical defective

A critical defective contains one or more critical and may also contain major and/or minor defects.

Major defective

A major defective contains one or more defects and may also contain minor defects but contains no critical defect.

Minor defective

A minor defective contains one or more minor defects but contains no critical and major defects.

3.2.7. EXPRESSION OF DEFECTIVES

$$\text{Percent of defects} = \frac{\text{Number of defects}}{\text{Number of products inspected}} \times 100\%$$

3.2.8. INSPECTION STANDARD

Unless otherwise specified, the inspection standard will be defined by MIL- STD-105E(ISO-2859), SINGLE SAMPLING PLAN. level II is in use all the time , inspection levels are normal ,reduce and tighten .

Acceptance Quality Level

When a critical defect is found, this must be reported immediately upon detection, the lot or batch shall be rejected and further shipments shall be held up pending instructions from the responsible person in relevant organization.

Major Defective: 0.4 AQL
Minor Defective: 1.50 AQL

3.2.9. GENERAL RULES

The inspection must be carried out by trained inspectors having good knowledge of the meaning of "fitness for use". The inspection must be based upon the documents concerning the completely assembled and packed product when more defects appear with the same cause only the most serious defect must be taken into account. Defects found in accessories packed with the product as connecting cables, plugs, adapters and the like, and being inspected as a part of the complete product, must be included in the evaluation.

The evaluation must be within the limits of the product specification and, for not specified characteristics, be related to the design model, limit samples or judgment of a jury of experts. Faults must be demonstrable.

3.2.10. TEST CONDITIONS

Unless otherwise prescribed, the test conditions are as follows:

. Nominal mains voltage
Temperature: +5~+35℃
. Warm up time : 30minutes minimum .
. Visual inspection shall be down with the distance from eyes to the sample 35-50 cm .
. Display mode: Primary mode 1920 x 1080

3.2.11. TEST EQUIPMENTS

1. PC with display adapter or other specific display adapter which is agreed upon by both parties
2. Test program by BenQ
3. Ruler
4. Power saving test tool
5. Minolta color analyzer (CA-110 or BM – 7)

3.2.12. VISUAL INSPECTION CRITERIA

1. PACKING
2. ACCESSORIES
3. APPEARANCE
4. AC POWER AND SIGNAL CABLE
5. INTERIOR OF THE PRODUCT

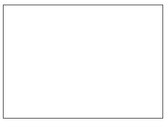
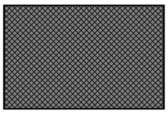
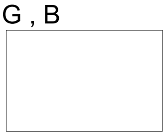
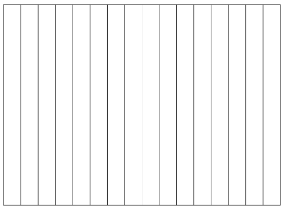
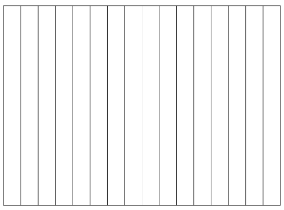
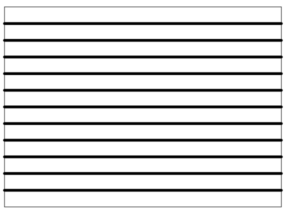
No	Description	Class
1	**Packing**	
1.1	Wrong packing material	Major
1.2	Carton damaged(over 6cm dia).wet, badly taped or stapled, product will not arrive in good condition at customer	Minor
1.3	Carton damaged(3cm to 6cm dia), badly taped or stapled , product will arrive in good condition at customer	Minor
1.4	Wrong marking of trade mark	Major
1.5	Wrong marking of model number	Major
1.6	Wrong serial # marking on carton	Major
1.7	Product wrongly placed in box (upside down)	Major
1.8	Broken polyfoam or PU foam	Major
1.9	Broken packing bag	Major
1.10	Wrong size or poor printing for artwork/character	Major
1.11	Bar-code wrong, missing, or damaged	Major
1.12	Label on box missing or damaged	Major
1.13	Strange object in the box	Major
1.14	Unit not corresponding to model stated on external label	Major
1.15	Superficial breaking 5 ~ 10 cm dia	Minor
2	**Accessories**	
2.1	Missing accessory parts	Major
2.2	Wrong Accessory parts	Major
3	**Appearance of product**	
3.1	Incorrect color of cabinet	Major
3.2	Incorrect color of tilt/swivel base	Major
3.3	Wrong logo or name plate	Major

No	Description	Class
3.4	Poor print of logo or name plate	Major
3.5	Label on product Wrong or missing	Major
3.6	Scratched or dirty but legible spec. label	Minor
3.7	GAP between LCD and front bezel is over 2.0 mm	Major
3.8	Dot/area discolor over 1mm dia. in front or over 2mm dia. in other areas	Major
3.9	Cabinet warped, sagged or bulging ＞0.5% of surface length	Major
3.10	Cabinet warped, sagged or bulging noticeable but ＜0.5% of surface length	Minor
3.11	Sharp stud or edge, which can cause damage not safe	Major
3.12	Finishing of piece parts will not arrived in good condition at the customer	Major
3.13	Cabinet step (between housing and bezel) ＞1.0mm , < 1.5mm	Minor
3.14	Cabinet step (between housing and bezel) ＞1.5mm	Major
3.15	Wiring or fixing cord comes out of cabinet or jammed	Major
3.16	Auxiliary material used during production not removed	Major
3.17	Cabinet parts come loose during normal handling, not safe	Critical
3.18	Cabinet parts come loose during normal handling, but safe	Major
3.19	Tilt/swivel too flexible/not working	Major
3.20	Tilt/swivel stiff	Minor
3.21	Dirty front bezel and housing can't remove	Major
3.22	Dirty front bezel and housing removable easily	Minor
3.20	Sticker or loose user control switch which will not function correctly	Major
3.21	Missing knob or switch, not safe	Critical
3.23	Missing knob or switch, but safe	Major
3.24	Poor functional user controls in mechanical	Major
3.25	Unreadable printing of user controls label	Major
3.26	Rubber foot missing	Major
3.27	LED wrong material or missing	Major
3.28	LED sagged >1.0mm or bulging>0.5mm	Minor
3.29	Wrong S/N between spec. label and monitor display	Major
4	**AC power and signal cable**	
4.1	AC power or connector not correct or damaged, not safe	Critical
4.2	AC power or connector not correct or damaged, but safe	Major
4.3	Signal cable contact pin dirty	Minor
4.4	Signal cable plug dirty or surface damaged, but safe	Minor
4.5	Cable crack	Major
4.6	Cable scratch (wire not exposed), or dirty	Major
4.7	AC-DC adapter no function	Minor
4.8	Signal cable contact pin dirty	Major
5	**Interior of the product**	
5.1	Use Non-QVL (Qualify vendor list)component	Major
5.2	Wrong parts, broken component, but safe	Major
5.3	Foreign material	
	Conductive (Has potential to short circuit)	Major
	Non-conductive (Moveable)	Minor
5.4	Missing hardware, component or screw, stripped screw	Major
5.5	Loose hardware/screw or insufficient torque	Major
5.6	Poor wire routing, which is no concerned on EMI	Minor
5.7	Cold soldering/loose connections (Electrical)	Major
5.8	Wires and mechanical structure do not meet UL/CSA or TUV	Critical
5.9	Wrong parts, broken component, not safe	Critical
5.10	Component burn	Critical

3.2.13. OPERATIONAL INSPECTION CRITERIA

1. TEST PATTERN
2. SPECIFICATIONS
3. OPERATIONAL INSPECTION CRITERIA

3.2.13.1. List of test pattern

KEY	PATTERN	TEST ITEM
A	FULL WHITE 	H - Size , V – Size .Viewing Angle Light Output Impurity, Spot check Contrast Ratio Brightness adjust Range
E	DARK 	Background, Spot check
F	FULL W , R , G , B 	Impurity, Spot check .CIE Coordinate check
G	256 COLORS 	Color Check
H	16 GREY 	Gray Check
H	Black/White stripe pattern 	Electric characteristics

3.2.13.2. Video performance

Item	Spec	OK	N.A	Remark
Max. support Pixel rate	170 MHz	√		Both for analog and digital inputs
Max. Resolution	1920x1080@60	√		Both for analog and digital inputs
Rise time + Fall time	<5.89 ns (50% of minimum pixel clock period)	√		1920 x 1080 @ 60Hz (max. support timing)
Settling Time after overshoot /undershoot	< 5% final full-scale value	√		Refer to VESA VSIS Standard V1R1
Overshoot/Undershoot	< 12% of step function voltage level over the full voltage range	√		Refer to VESA VSIS Standard V1R1

3.2.14. PANEL INSPECTION CRITERIA

Inspection Item	Specification
Line defect	Can’t be seen
Bright Dot	<=2 dots
Green bright dots	<=2 dots
Dark dots	<=4 dots
Total dots defect	<=5 dots
Continuous Defect	Two continuous bright dots(vertical ,horizontal, oblique):<=1 pair Exclude continuous green-green bright dots
	Three or more continuous bright dots (vertical, horizontal ,oblique):Not allowed
	Two continuous dark dots(vertical ,horizontal, oblique):<=2 pairs
	Three or more continuous dark dots(vertical, horizontal, oblique):Not allowed
	Distance between 2B dots:>=15mm Distance between 2Ddots:>=15mm Distance between B and D dot :>=10mm

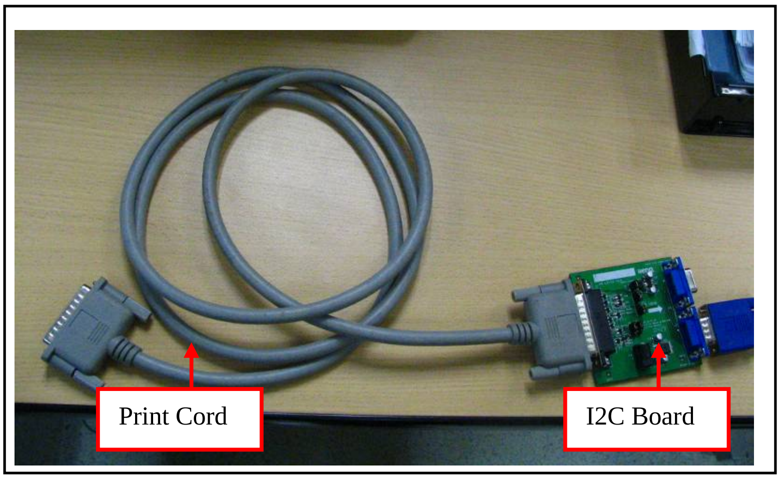
Note:
This Panel Specification is subject to change. Please check it on eSupport system for latest update.

4 Level 1 Cosmetic / Appearance / Alignment Service

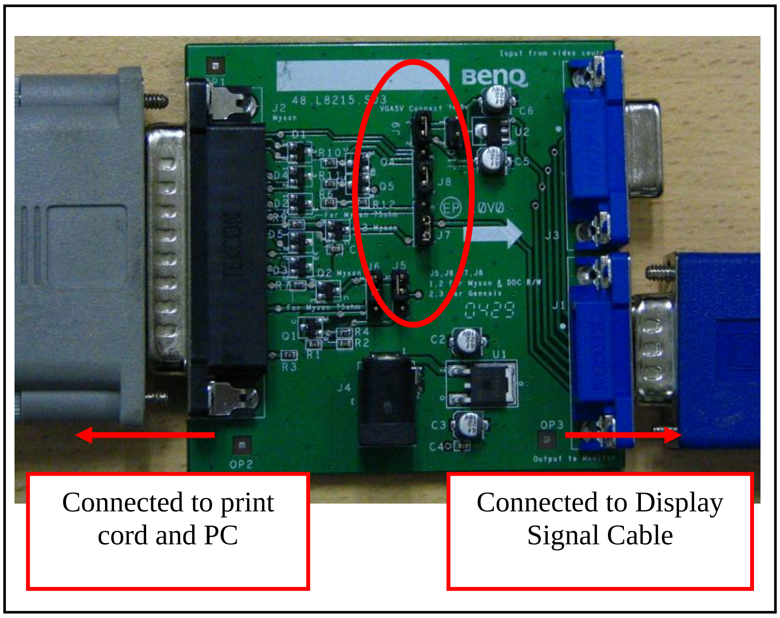
4.1. Software / Firmware Upgrade Process

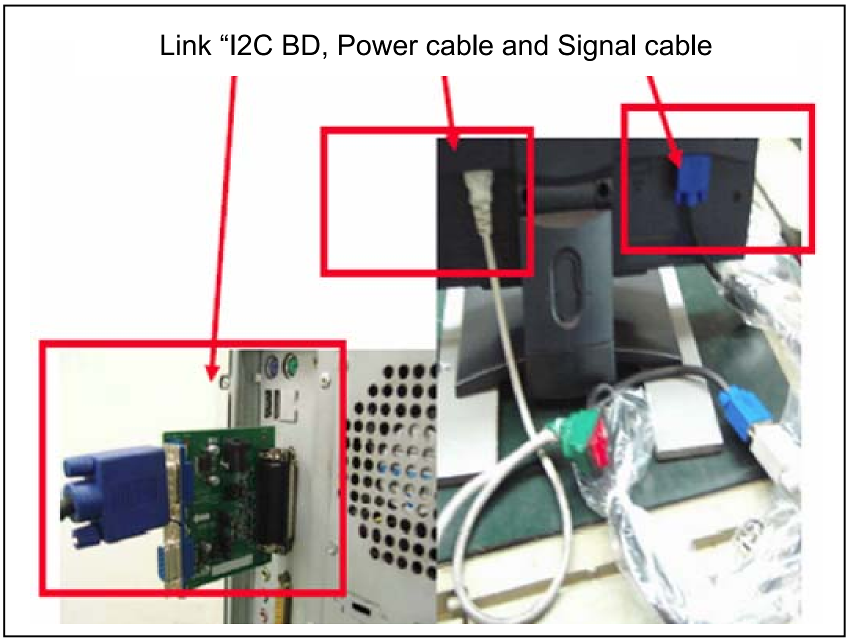
4.1.1 Hardware Requirement:

1. I2C board x 1 (a.Print Board b. I2C Board)
2. DSUB VGA cables x 2
3. Printer cable (with one male connector and another female connector) x 1.
4. PC or Notebook with parallel (printer) port x1.



Check the Jumpers on the I2C circuit board (make sure J5/J6/J7/J8 are set at Pin 1 & Pin 2 short)





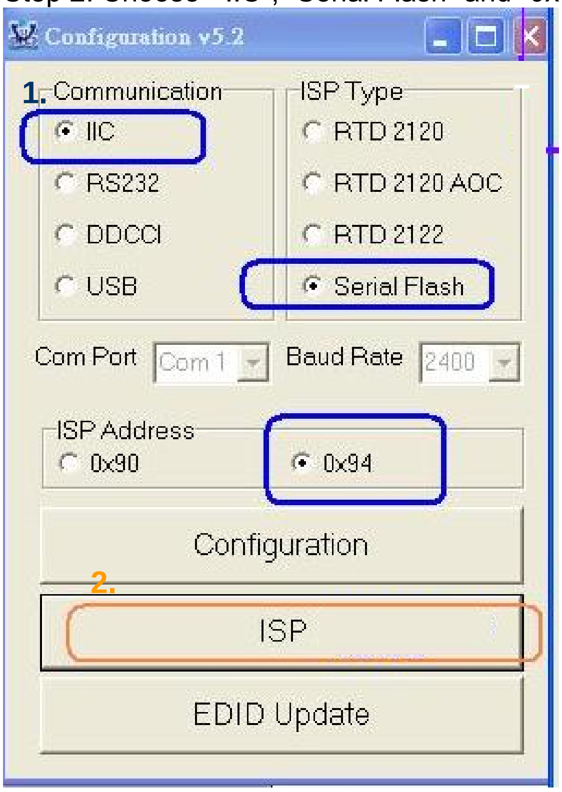
4.1.2 Software prepare

1. Realtek.exe



Step 1: Press RTD Tool

Step 2: Choose “ IIC”, “Serial Flash” and “0x94”. Then, press “ISP”



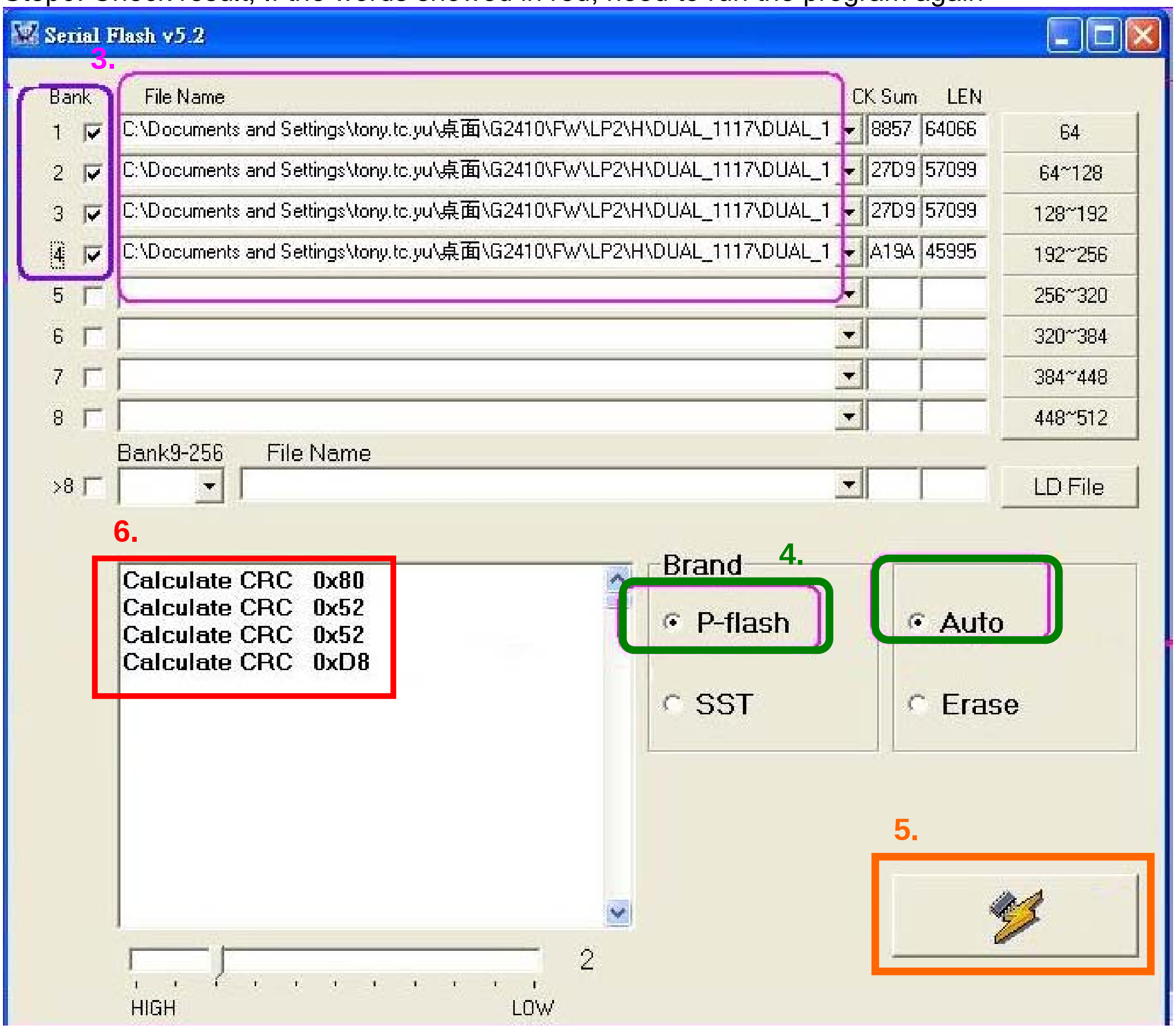
Step 3: Click the “Bank” and Find the F/W

1. xxx.H00
2. xxx.H01
3. xxx.H02
4. xxxEXT.Hex

Step4: Choose “P-Flash” and “Auto”

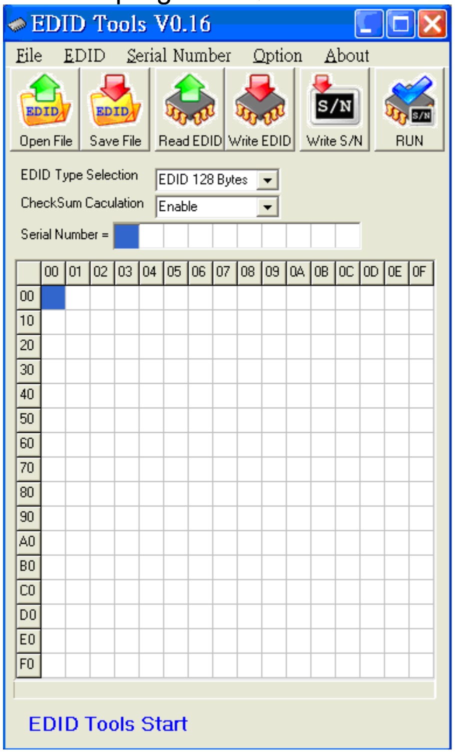
Step5: Press  to run the program

Step6: Check result, If the words showed in red, need to run the program again

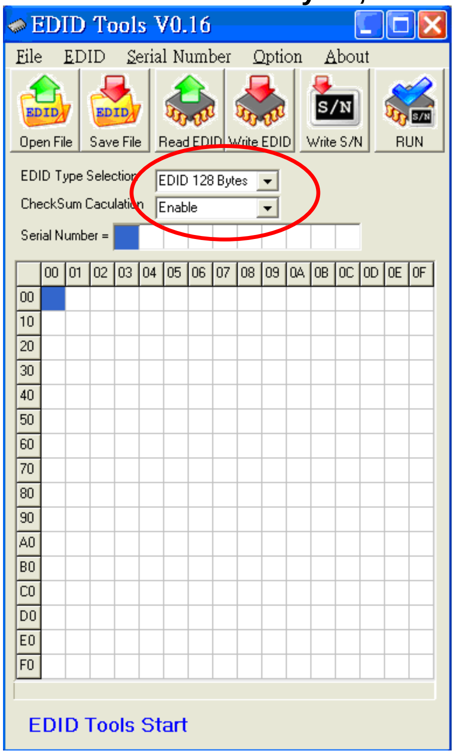


4.1.3 EDID Upgrade Procedure

Step 1: Run the program “Q-EDID-V016.exe”, when the UI popped up



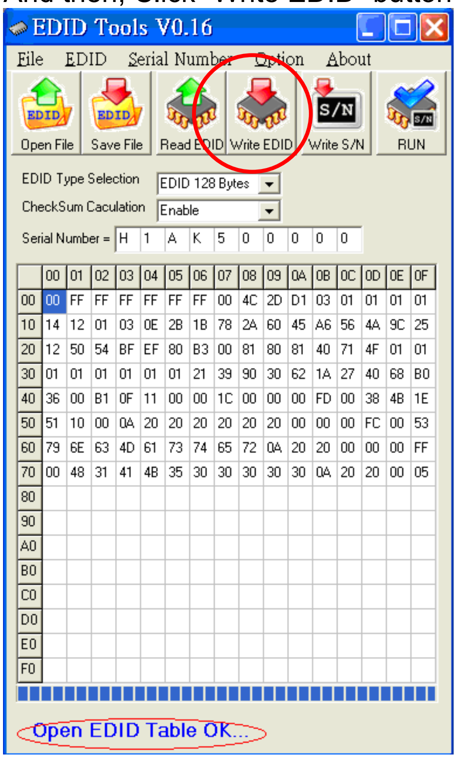
Note: If “VGA” choose 128bytes, and “HDMI” choose 256bytes



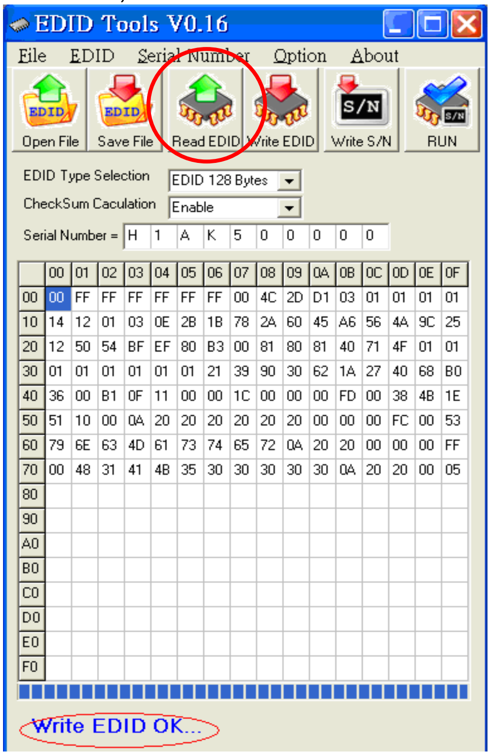
Step 2: Click “Open File” and select “VGA” or “HDMI” EDID file



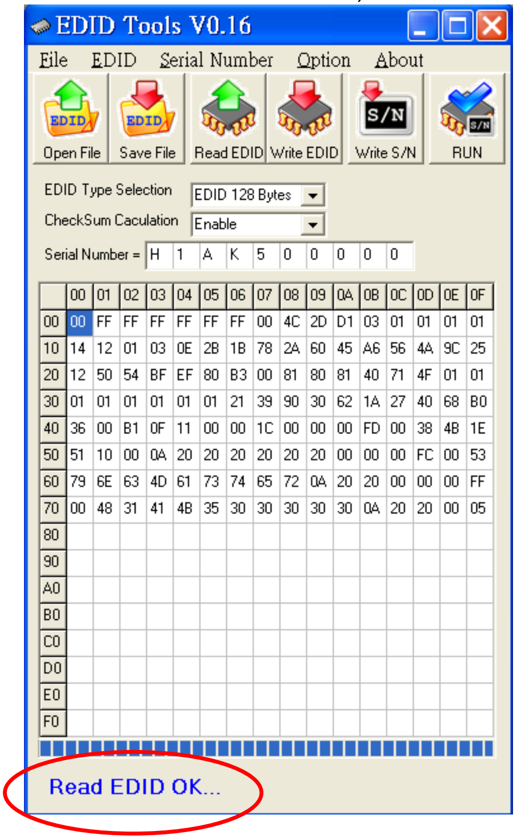
Step 3: If load file is successful, it shows “Open EDID Table OK.”
And then, Click “Write EDID” button to update EDID



Step 4: If write EDID is successful, it shows "Write EDID OK …"
And then, click "Read EDID" button to check if successful or not.



Step 5: If read EDID is successful, it shows" Read EDID OK …"



4.2. Alignment procedure (for function adjustment)

A. Preparation:

1. Setup input timing ICL-605(1280x1024@75Hz), Pattern:5-Mosaic.
2. Setup unit and keep it warm up at least 30 minutes.

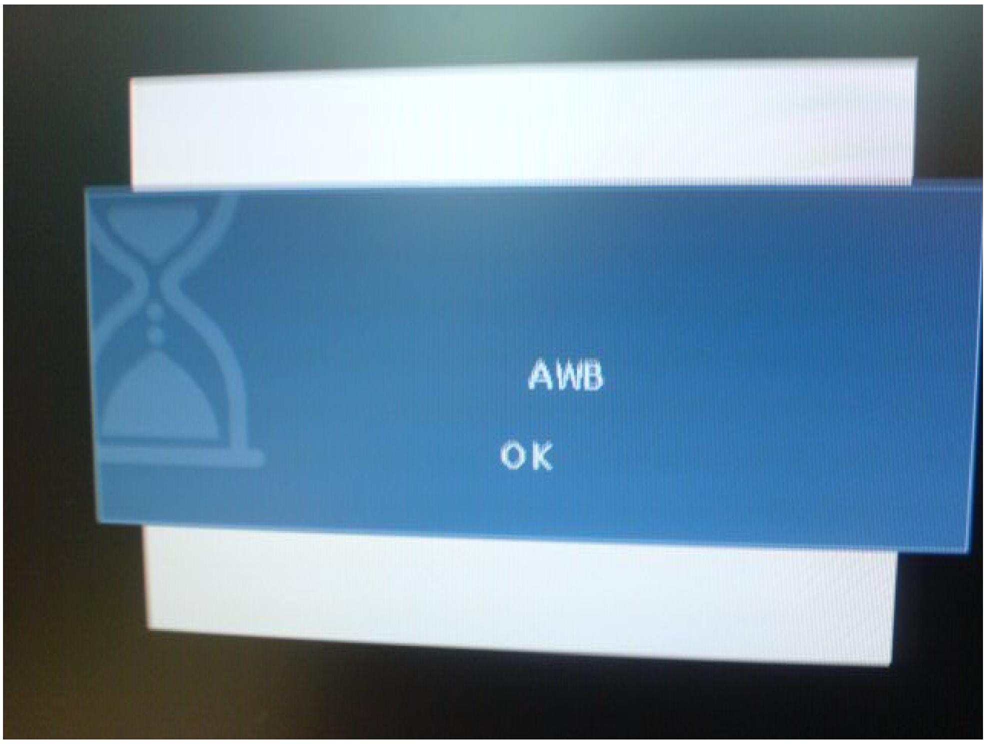
B. Timing adjustment:

1. Enter factory setting area (press “ENTER”, “MENU” and then press “SOFTPOWER”).
2. Check the settings to following values:
   Contrast = 50
   Brightness = 90
   Color = User Mode
   Senseye mode = Standard
   Language = English
   Burn In =ON

   Then, turn off the monitor power.
3. Turn on power enter user area.

C. Color balance adjustment:

1. Enter factory setting area (press “ENTER”, “MENU” and then press “SOFTPOWER”).
2. Setup input timings WS7(1280x1024@75Hz), Pattern:5-Mosaic.
3. Setup Color mode “User Mode”.
4. Press “I-KEY”(or Left key directly), and then OSD will show “White Balance” item and then press “ENTER” button to do auto color.



D. Color adjustment:

1. Setup input timing ICL-605, white pattern.
2. Confirm auto color adjustment had already done.
3. Measure color temperature by Minolta CA-110 (or equivalent equipment).
4. Check the color temperature Bluish, Reddish & Normal. The color temperature specification as follows:

White Balance (Bluish, 9300K set on OSD)	X+-	0.283+(-) 0.015
	Y+-	0.297+(-) 0.015
White Balance (Reddish, 5800K set on OSD)	X+-	0. 326+(-) 0.015
	Y+-	0. 342+(-) 0.015
White Balance (sRGB, 6500K set on OSD)	X+-	0.313+(-) 0.015
	Y+-	0. 329 +(-) 0.015

5. Setup input timing, 32 -Gray pattern.

   To check if there are any abnormal display problems of preset timing modes

Check the following preset timings with General pattern:

No.	Mode	H	V
1	720×400 @ 70Hz	31.468	70.8
2	640×480 @ 60Hz	31.469	59.940
3	640×480 @ 75Hz	37.500	75.000
4	800×600 @ 60Hz	37.879	60.317
5	800×600 @ 75Hz	46.875	75.000
6	1024×768 @ 60Hz	48.363	60.004
7	1024×768 @ 75Hz	60.023	75.029
8	1152x864 @ 75Hz	67.500	75.000
9	1280×1024 @ 60Hz	63.981	60.020
10	1280×1024 @ 75Hz	79.976	75.025

6. Checking if the picture is no good, reject this monitor.
7. To check the power consumption by disabling “burn-in mode” setting
8. To clear user data and program complete DDC data to monitor by IIC bus communication.

E. Writing EDID file:

1. Setup a PC with DDC card.
2. Connect PC to monitor with a D-sub(DVI) signal cable.
3. Please refer to the C212 for the correct EDID file.
4. Runs the writing program to write the EDID file into EEPROM .
5. Read EEPROM data and confirm it to match with the C212 document definition.

F. Command definition :

PC Host will send 0x7C IIC slave address and then following 4 bytes command

I2C Send Command	Byte1	Byte 2	Byte 3	Byte4	OK	N.A.	Remark
Write Contrast to MCU RAM	CA	55	Data	cksum	√		Write data to MCU RAM and update the related register to refresh the screen immediately. Don't store data to EEPROM.
Write Brightness to MCU RAM	CA	56	Data	cksum	√		
Write Red Gain to MCU RAM	CA	57	Data	cksum	√		
Write Green Gain to MCU RAM	CA	58	Data	cksum	√		
Write Blue Gain to MCU RAM	CA	59	Data	cksum	√		
Read Contrast from MCU RAM	C3	55	XX	cksum	√		
Read Brightness from MCU RAM	C3	56	XX	cksum	√		
Read Red Gain from MCU RAM by color index	C3	57	XX	cksum	√		Base on current color index to read back the right gain value.
Read Green Gain from MCU RAM by color index	C3	58	XX	cksum	√		
Read Blue Gain from MCU RAM by color index	C3	59	XX	cksum	√		
Write C1 (Bluish) R-Gain Data to EEPROM	AA	3C	Data	cksum	√		
Write C1 (Bluish) G-Gain Data to EEPROM	AA	3D	Data	cksum	√		
Write C1 (Bluish) B-Gain Data to EEPROM	AA	3E	Data	cksum	√		
Write C2 (sRGB) R-Gain Data to EEPROM	AA	4C	Data	cksum	√		
Write C2 (sRGB) G-Gain Data to EEPROM	AA	4D	Data	cksum	√		
Write C2 (sRGB) B-Gain Data to EEPROM	AA	4E	Data	cksum	√		
Write C3 (Reddish) R-Gain Data to EEPROM	AA	5C	Data	cksum	√		
Write C3 (Reddish) G-Gain Data to EEPROM	AA	5D	Data	cksum	√		
Write C3 (Reddish) B-Gain Data to EEPROM	AA	5E	Data	cksum	√		
Write User R-Gain Data to EEPROM	AA	6C	Data	cksum	√		
Write User G-Gain Data to EEPROM	AA	6D	Data	cksum	√		
Write User B-Gain Data to EEPROM	AA	6E	Data	cksum	√		

Write Cx R-Gain Data to EEPROM	AA	7C	Data	cksum		√	Reserved for some model have extra color temperature
Write Cx G-Gain Data to EEPROM	AA	7D	Data	cksum		√	
Write Cx B-Gain Data to EEPROM	AA	7E	Data	cksum		√	
Write Contrast to EEPROM	AA	92	Data	cksum	√		
Write Brightness to EEPROM	AA	93	Data	cksum	√		
Write C/T index to EEPROM	AA	94	1~4	cksum	√		1=C1/9300/Bluish, 2=C2/6500/sRGB/, 3=C3/5800/Reddish, 4=User, 5=Cx
Write OSD-Hpos to EEPROM	AA	95	Data	cksum	√		
Write OSD-Vpos to EEPROM	AA	96	Data	cksum	√		
Write Language to EEPROM	AA	97	0~17	cksum	√		(Also Update MCU RAM) 1=English, 3=French, 0=Deutsch, 4=Italian, 2=Spanish, 5=JAPAN, 6=繁中, 7=簡中 8=Hungarian, 9=Serbian, 0A=Russian, 0B=Dutch, 0C=Polish, 0D=Czech, 0E=Swedish, 0F=Portugese, 10=Romanian
Write EEPROM OSD Timer	AA	98	Data	cksum	√		
Write EEPROM Volume	AA	99	Data	cksum	√		
Write EEPROM Gamma index	AA	9A	Data	cksum		√	For model with Gamma curve selection function
Write OSD Transparency to EEPROM	AA	9E	Data	cksum		√	
Write OSD Rotation to EEPROM	AA	9F	Data	cksum		√	
Read C1 (Bluish) R-Gain data from EEPROM	A3	3C	XX	cksum	√		
Read C1 (Bluish) G-Gain data from EEPROM	A3	3D	XX	cksum	√		
Read C1 (Bluish) B-Gain data from EEPROM	A3	3E	XX	cksum	√		
Read C2 (sRGB) R-Gain data from EEPROM	A3	4C	XX	cksum	√		
Read C2 (sRGB) G-Gain data from EEPROM	A3	4D	XX	cksum	√		

Read C2 (sRGB) B-Gain data from EEPROM	A3	4E	XX	cksum	√		
Read C3 (Reddish) R-Gain data from EEPROM	A3	5C	XX	cksum	√		
Read C3 (Reddish) G-Gain data from EEPROM	A3	5D	XX	cksum	√		
Read C3 (Reddish) B-Gain data from EEPROM	A3	5E	XX	cksum	√		
Read User R-Gain data from EEPROM	A3	6C	XX	cksum	√		
Read User G-Gain data from EEPROM	A3	6D	XX	cksum	√		
Read User B-Gain data from EEPROM	A3	6E	XX	cksum	√		
Read Cx R-Gain data from EEPROM	A3	7C	XX	cksum		√	Reserved for some model have extra color temperature
Read Cx G-Gain data from EEPROM	A3	7D	XX	cksum		√	
Read Cx B-Gain data from EEPROM	A3	7E	XX	cksum		√	
Read Contrast from EEPROM	A3	92	XX	cksum	√		
Read Brightness from EEPROM	A3	93	XX	cksum	√		
Read C/T index from EEPROM	A3	94	XX	cksum	√		1=C1/9300/Bluish, 2=C2/6500/sRGB/, 3=C3/5800/Reddish, 4=User, 5=Cx
Read OSD-Hpos EEPROM	A3	95	XX	cksum	√		
Read OSD-Vpos from EEPROM	A3	96	XX	cksum	√		
Read Language from EEPROM	A3	97	XX	cksum	√		1=English, 3=French, 0=Deutsch, 4=Italian, 2=Spanish, 5=JAPAN, 6=繁中, 7=簡中 8=Hungarian, 9=Serbian, 0A=Russian, 0B=Dutch, 0C=Polish, 0D=Czech, 0E=Swedish, 0F=Portugese, 10=Romanian
Read OSD Timer from EEPROM	A3	98	XX	cksum	√		
Read Volume from EEPROM	A3	99	XX	cksum	√		
Read Gamma index from EEPROM	A3	9A	XX	cksum		√	For model with Gamma curve selection function
Read OSD Transparency from EEPROM	A3	9E	XX	cksum		√	

Read OSD Rotation from EEPROM	A3	9F	XX	cksum		√	
Change Color Temp. to C1/9300K/Bluish	CC	01	XX	cksum	√		Change C/T immediately. And store C/T index to EEPROM.
Change Color Temp. to C2/6500K/sRGB	CC	02	XX	cksum	√		
Change Color Temp. to C3/5800K/Reddish	CC	03	XX	cksum	√		
Change Color Temp. to User	CC	04	XX	cksum	√		
Change Color Temp. to Cx	CC	05	XX	cksum		√	Reserved
Change Input Source to D-Sub	CD	01	XX	cksum		√	
Change Input Source to DVI	CD	02	XX	cksum		√	
On burn in mode	CE	01	XX	cksum	√		Store data to EEPROM
Off burn in mode	CE	XX*	XX	cksum	√		XX* = Non “1” value Store data to EEPROM
Monitor is forced power saving	CF	01	XX	cksum		√	
Monitor wake up from power saving	CF	XX*	XX	cksum		√	XX* = Non “1” value
Change Sense-Eye mode to Standard	C0	00	XX	cksum		√	Change Sense-Eye mode immediately. And store the index to EEPROM.
Change Sense-Eye mode to Movie1	C0	01	XX	cksum		√	
Change Sense-Eye mode to Movie2	C0	02	XX	cksum		√	
Change Sense-Eye mode to Photo	C0	03	XX	cksum		√	
Set luminance sensor mode to Off	C1	00	XX	cksum		√	Change luminance sensor mode immediately. And store the index to EEPROM.
Set luminance sensor mode to Bright	C1	01	XX	cksum		√	
Set luminance sensor mode to Moderate	C1	02	XX	cksum		√	
Set luminance sensor mode to Dim	C1	03	XX	cksum		√	
Increase ADC R-Offset2	AC	23	Data	cksum	√		
Increase ADC G-Offset2	AC	24	Data	cksum	√		
Increase ADC B-Offset2	AC	25	Data	cksum	√		
Increase ADC R-Gain	AC	33	Data	cksum	√		
Increase ADC G-Gain	AC	34	Data	cksum	√		

Increase ADC B-Gain	AC	35	Data	cksum	√		
Decrease ADC R-Offset2	AD	23	Data	cksum	√		
Decrease ADC G-Offset2	AD	24	Data	cksum	√		
Decrease ADC B-Offset2	AD	25	Data	cksum	√		
Decrease ADC R-Gain	AD	33	Data	cksum	√		
Decrease ADC G-Gain	AD	34	Data	cksum	√		
Decrease ADC B-Gain	AD	35	Data	cksum	√		
Read ADC R-Offset2	AE	23	XX	cksum	√		
Read ADC G-Offset2	AE	24	XX	cksum	√		
Read ADC B-Offset2	AE	25	XX	cksum	√		
Read ADC R-Gain	AE	33	XX	cksum	√		
Read ADC G-Gain	AE	34	XX	cksum	√		
Read ADC B-Gain	AE	35	XX	cksum	√		
User mode to factory mode	1A	5A	XX	cksum	√		
Auto Color (Offset1, Offset2, Gain)	1B	5A	XX	cksum		√	
Copy EDID Serial number to EEPROM	1C	5A	XX	cksum		√	For specified “Industry Customer” model.
Factory mode to User mode	1E	5A	XX	cksum	√		
Clear user mode and factory recall	1F	5A	XX	cksum	√		Store data to EEPROM
Write EDID data to MCU DDC RAM	55	NA	NA	NA	√		For MTV312 MCU type
Copy DDC RAM data to EEPROM	BB	NA	NA	NA	√		For MTV312 MCU type
Drive WP pin to low to enable write DDC IC	55	NA	NA	NA		√	For stand alone DDC IC
Drive WP pin to high to disenable write function	BB	NA	NA	NA		√	For stand alone DDC IC
Switch DDC bus to **DVI-A** DDC IC	44	NA	NA	NA		√	For input signal with multi-input source
Switch DDC bus to **DVI-D** DDC IC	33	NA	NA	NA		√	For input signal with multi-input source
Change Senseye Mode	C0	0~3	XX	cksum		√	

Change Power Status	D0	Data	XX	cksum	√		PowerOFF: Data=AA PowerON: Data=Other Value
Change Language Type	D1	Data	XX	ckssum		√	Asia: Data=AA European: Data=Other Value
EEPROM Bank R/W (For Debug using only, not for Production Line Write EEPROM directly)							
Read EEPROM Bank 0	B0	Address	XX	cksum	√		
Read EEPROM Bank 1	B1	Address	XX	cksum	√		
Read EEPROM Bank 2	B2	Address	XX	cksum		√	(For 24C08 type)
Read EEPROM Bank 3	B3	Address	XX	cksum		√	(For 24C08 type)
Write EEPROM Bank 0	B8	Address	Data	cksum	√		
Write EEPROM Bank 1	B9	Address	Data	cksum	√		
Write EEPROM Bank 2	BA	Address	Data	cksum		√	(For 24C08 type)
Write EEPROM Bank 3	BB	Address	Data	cksum		√	(For 24C08 type)

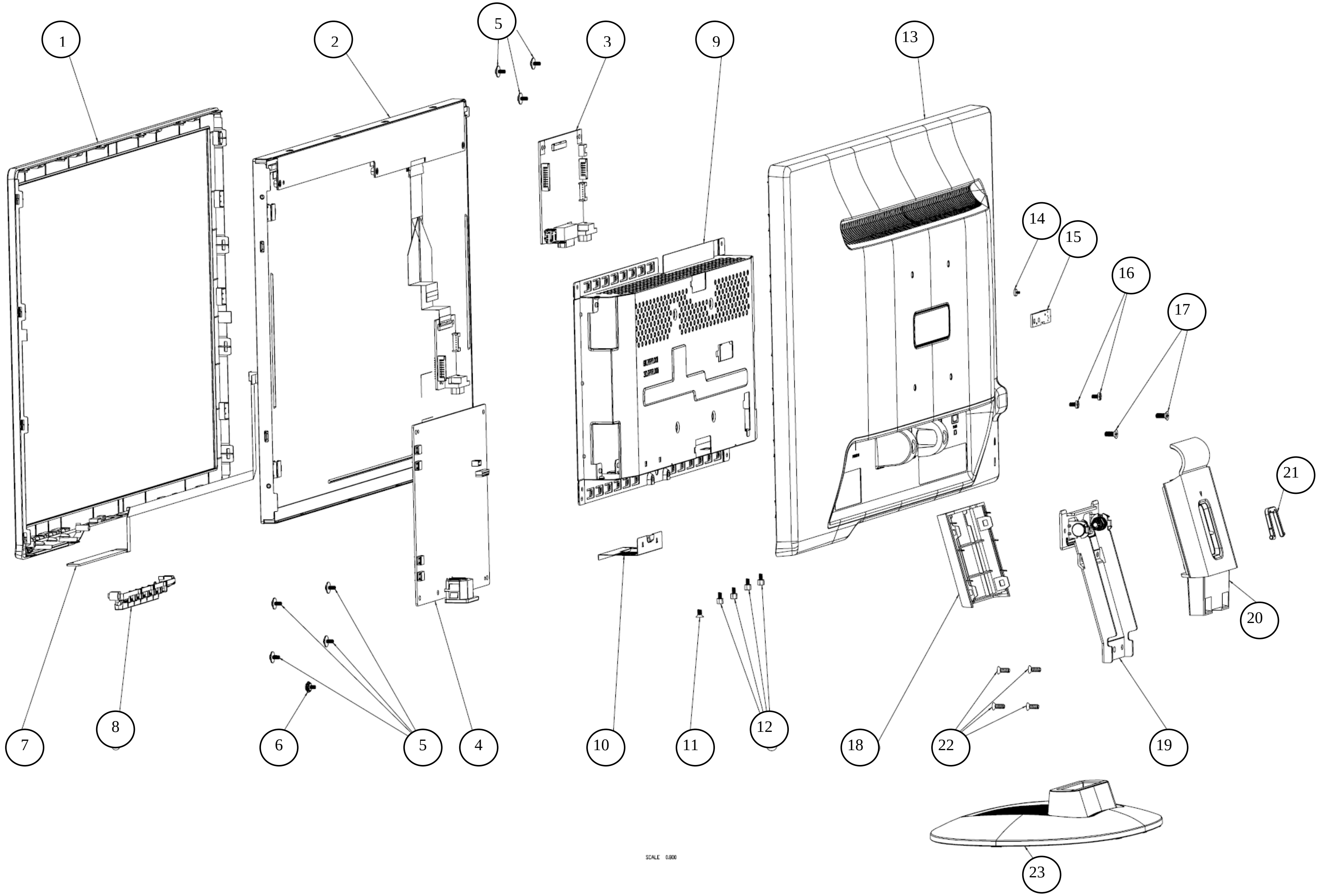
Note A: Byte4 (cksum) = Byte1 + Byte2 + Byte3
Note B: Data = The value write to MCU or EEPROM
Note C: XX = don't care, any value (<=0xFF).

When PC Host sends 0x7D command to MCU, MCU must return as following (2 bytes)

Return Code	R-Byte1	R-Byte2
Checksum error code	FC	AA
Normal return code	the above Byte3 (/data)	FC
If normal return code is exact FCh	FC	CF

5 Level 2 Disassembly /Assembly Circuit Board and Standard Parts Replacement

5.1. Exploded View



23	6K.0RM25.001	ASSY BASE DB49A	ASSEMBLY	1
22	8F.XA326.100	SCRW TAP FLAT M4*10L B-ZN	PART	4
21	4B.0BH07.011	CLIP WIRE PC+ABS DB49A	PART	1
20	4B.0RP03.011	CLM F ABS DB49A	PART	1
19	6K.0RM13.001	ASSY HINGE G2410HD	ASSEMBLY	1
18	4B.0RP04.011	CLM R ABS DB49A	PART	1
17	8F.5A356.8R0	SCRW MACH FH M4*8L B-ZN NYL	PART	2
16	8F.MA324.5R5	SCRW TAP FLAT-P M3*5.5L B-ZN	PART	2
15	5E.0BJ06.001	ASSY JACK-BD	ASSEMBLY	1
14	8F.00551.3R0	SCRW M FPH M2*3L (6/1.4) NI	PART	1
13	6K.0RM21.001	ASSY RC DUAL+H DB49A	ASSEMBLY	1
12	8F.205B4.019	SCRW MACH STEEL HEX #4-40 NI	PART	4
11	8F.5A224.6R0	SCRW MACH FLAT M3*0.5P*6L ZN	PART	1
10	3K.0RM02.001	BKT AC SPTE 0.3T G2410HD	PART	1
9	6K.0RM05.001	ASSY SHD DUAL+H G2411HD	ASSEMBLY	1
8	4B.0RM01.011	BTN ABS DB49A G2420HD	PART	1
7	5E.0RM03.001	ASSY CTRL-BD	ASSEMBLY	1
6	8F.VZ524.6R0	SCRW TAP FLAT+EXT M3*6L C-ZN	PART	1
5	8F.00273.6R0	SCRW TAP PH F/10WSH M3*6L C-ZN	PART	6
4	5E.0RM02.001	ASSY PWR-BD	ASSEMBLY	1
3	5E.0RM01.011	ASSY I/F-BD	ASSEMBLY	1
2	5F.LUDB0.051	PNL AUO M240HW01	PART	1
1	6K.0RM26.001	ASSY BZL DB49A	ASSEMBLY	1
ITEM	PART NO.	DESCRIPTION	TYPE	QTY

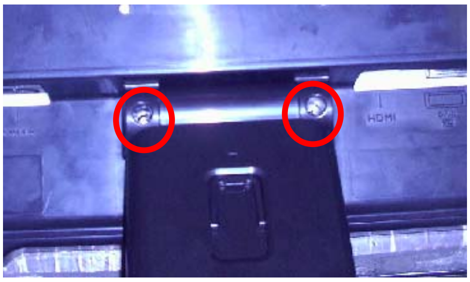
* This Service BOM is subject to change. Please check it on eSupport and SPO system before service parts order release.

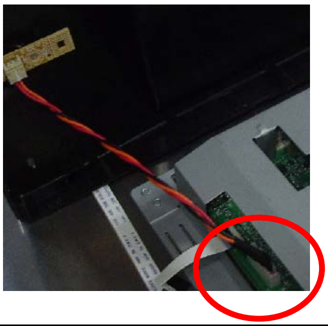
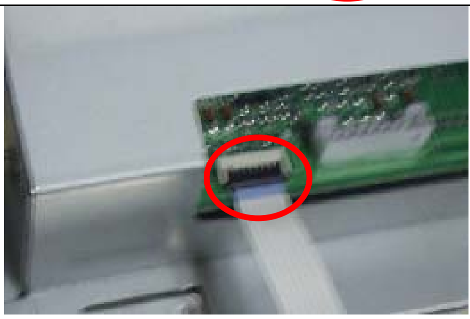
5.2. Disassembly /Assembly

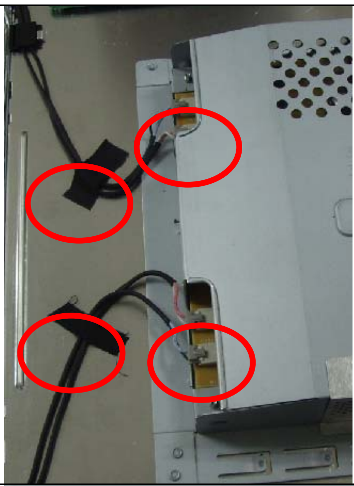
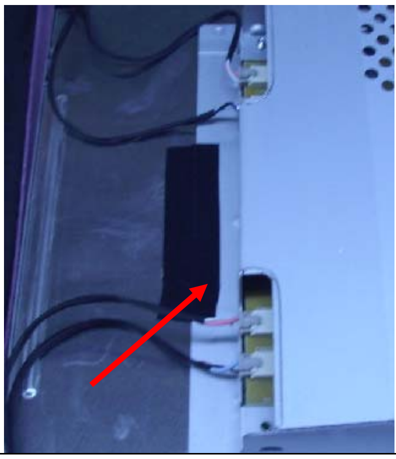
5.2.1 Disassembly SOP

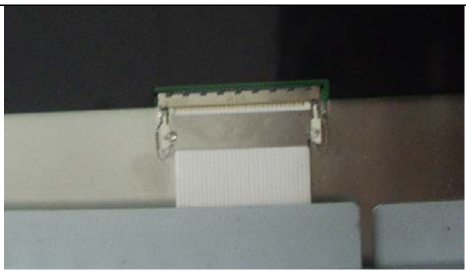
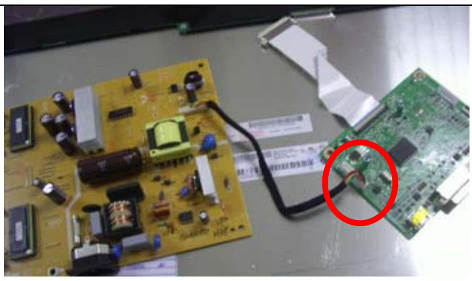
Preparation before disassemble

1. Clean the room for disassemble
2. Identify the area for monitor
3. Check the position that the monitors be placed and the quantity of the monitor; prepare the area for material flow; according to the actual condition plan the disassemble layout
4. Prepare the implement, equipments, material as bellow:
    1) Press-fixture
    2) working table
    3) Screw-driver
    4) knife*1
    5) glove
    6) cleaning cloth
    7) ESD protection

item	picture	Operation	Tool	Notes
1		Disassemble the stand → 2 screws	Screw-driver	
2		disassembly the bezel from the monitor, notice the disassembly order : 1.Left (1) parts of bezel 2.Top (2) parts of bezel 3.Bottom (3) parts of bezel 4. Right (4) parts of bezel Don't draw the BZL		When disassembly the bezel ,notice don't bend the C/B .man must wear glove The purpose is loose the BZL

3	 	Turn over the monitor ,dismantle the Rear cover from the monitor(if it have earphone function, pull the earphone wire out of the connector)		
4		Pull the c/b wire out of the c/b connector. Tear off the C/B wire from panel ,move away C/B and button		
5		Tear off the big aluminum foil.		

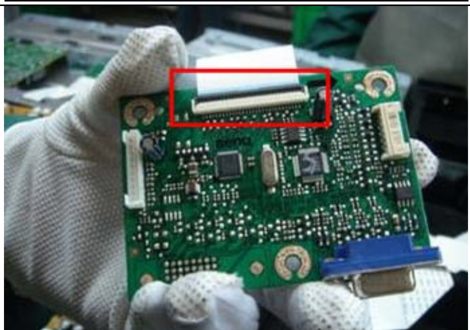
6		Tear off the two acetic tapes (if it have that) Pull out the light wires from connector .		
7		Disassemble the SHD		
8	 	Tear off all the tapes sticked on the BKT (including aluminum foils and acetic tapes)		

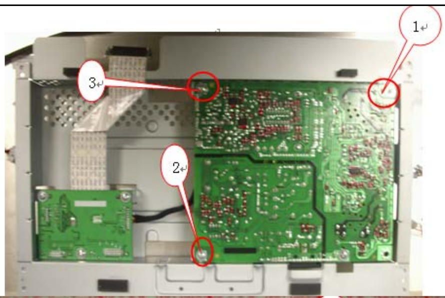
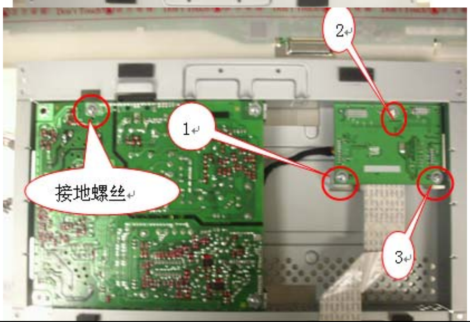
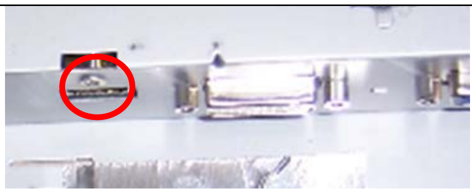
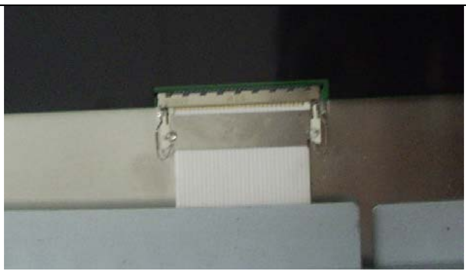
9		Tear off the yellow tape on the LVDS FFC ,and pull LVDS FFC out off the panel .		
10		Disassemble the hexangular screws (four or two)		
10		Turn over the BKT , and disassemble the power board and I/F board .-----→7 screws	Screw-driver	
11		Pull out the connector		

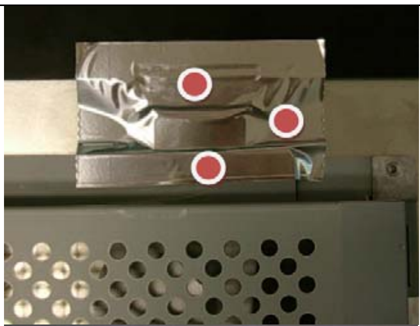
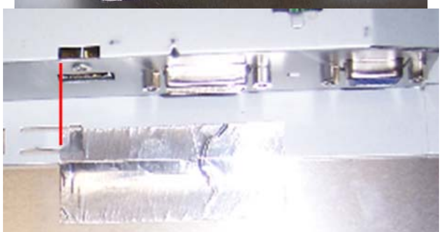
5.2.2 Assembly SOP

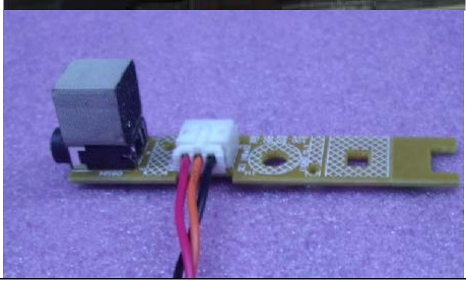
Preparation before assemble

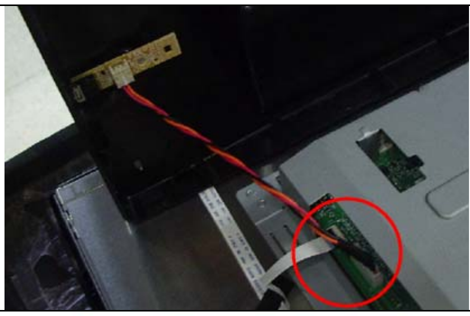
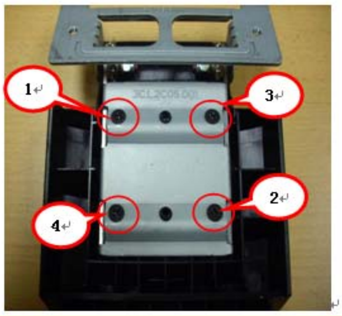
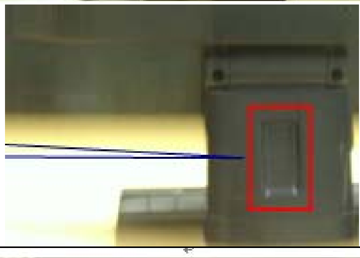
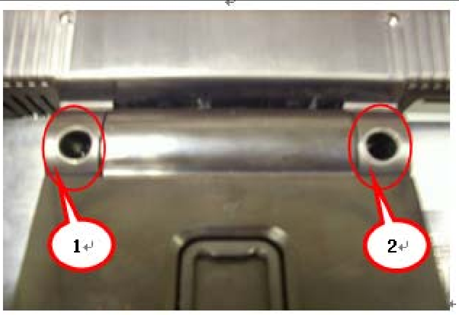
1. Clean the room for work
2. Identify the area for material
3. Prepare the implement, equipments, materials as bellow:
    1) Press-fixture
    2) working table
    3) Screw-driver
    4) knife*1
    5) glove
    6) cleaning cloth
    7) ESD protection

item	picture	Operation	Tool	Notes
1		Put panel on the cushion carefully,		
2		Fetch I/F board and LVDS FFC ,insert FFC into I/F .		
3		Fetch power board and put it into BKT, and put the connector wire into I/F connector ,then put I/F into BKT (like the pic. Showed)		

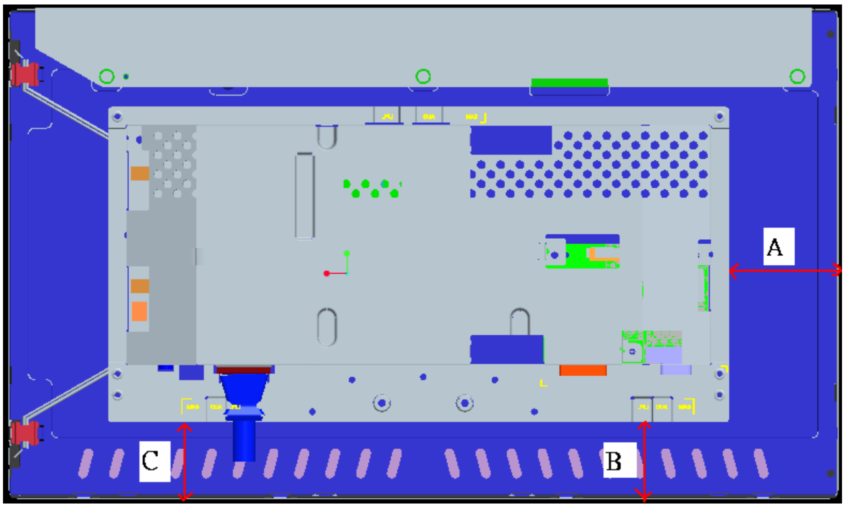
4		Lock PCBA screw .--→five or six PCBA screw ,one earth screw .	Screw driver : 7±1kg	
5		Turn over the bkt, and lock the hexangular screws (four or two)	Screw driver:5±0.6kg	
		Lock one HDMI screw (if it have that)	Screw driver: Side mount: 3±0.6 Other: 4±0.6	
6		Lock SHD on the BKT ,to fixup the P/B		
7		Insert LVDS FFC in the panel		

8		Fetch yellow tape, and stick it on the LVDS FFC		
9		Use location tool ,location the bkt on panel	location tool: G24101	
10	  	Stick tapes follow standard: One tape stick on angel side ,one on right side ,one on ground side . Stick acetic tapes on left		
11		Insert light wires, and make sure it connect well .		
		Use two acetic tapes fix the light wires .		

12		Stick big aluminum foil on the side (like left PIC)		
13		Fetch bezel ,and put panel into bezel (don't touch the LCD screen.		
14	 	Put c/b in the button, and put button in bezel. Tear the tapes on the back of c/b wire , insert c/b connector in I/F ,stick c/b on panel .		
15	 	Fetch cover ,cover the monitor .(if it have ear phone function ,assay earphone board on cover first, and insert the wire into I/F) First cover bottom ,then cover two sides ,last cover the angel side .	Screw driver(if it need) : 3+0.5KG Φ1.75±0.05 #1	

				
16	  	Assay stand .(follow picture on left .) put hinge in front cover ,and lock four screws, then cover the back cover ,last put the clip in front cover.	Screw driver : 7.5±0.5kg	
17		Put stand in monitor, and lock two screws .	Screw driver : 9.0±1.0kg	
18		Fetch base ,and assay base on monitor .		

5.3. Main-Shielding Position



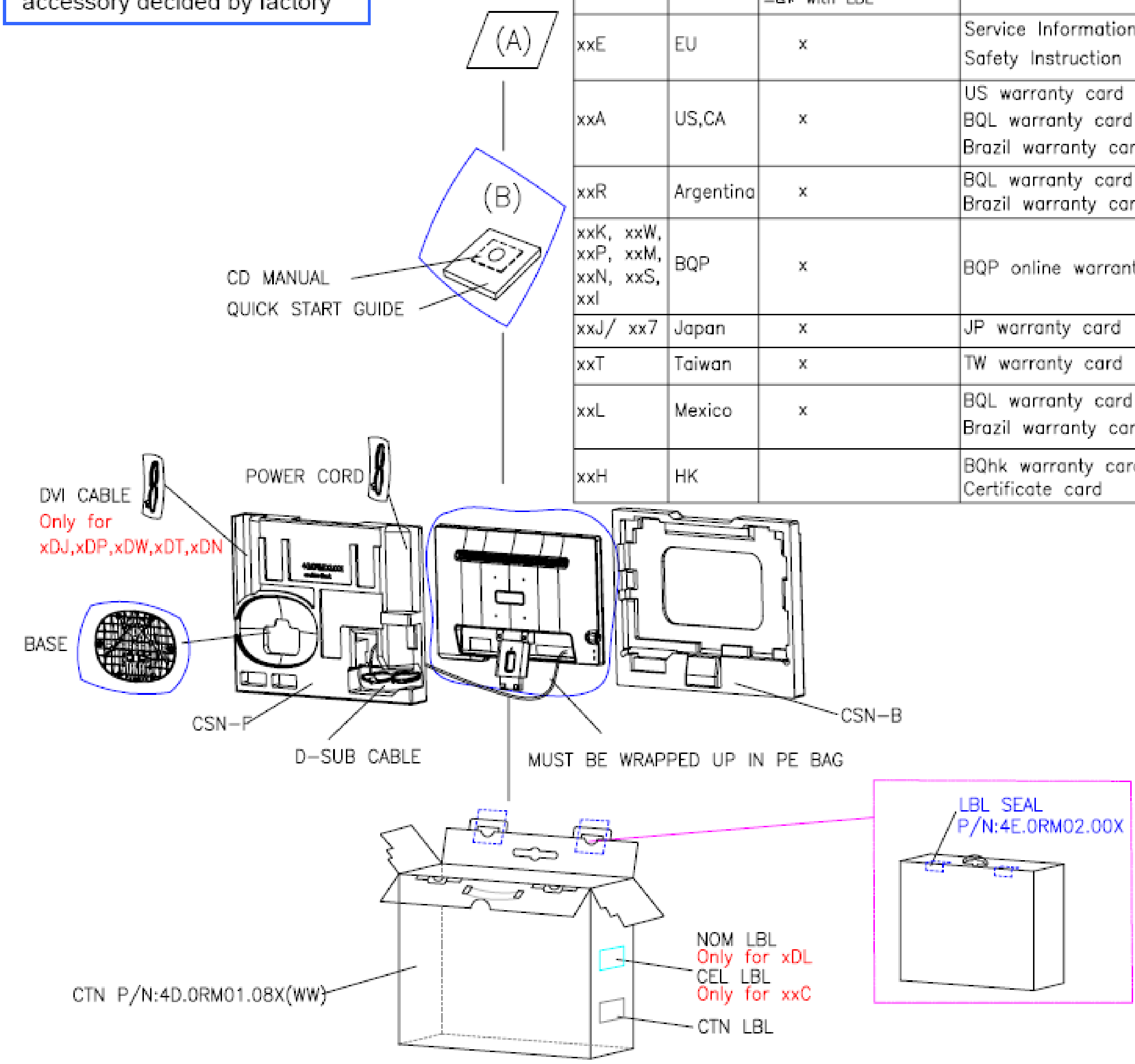
機種名稱	測點A尺寸	測點B尺寸	測點C尺寸
BenQ G900HD	56.69mm	40mm	40mm
BenQ G2220HD	84mm	44.5mm	44.5mm
BenQ G2020HD	69mm	42mm	42mm
BenQ G2410HD AUO	78.65mm	57.2mm	57.2mm
BenQ G2410HD CMO	72.65mm	55.85mm	55.85mm
BenQ T2200	56.69mm	40mm	40mm
BenQ G2420HD/G2420HDB	78.65mm	57.2mm	57.2mm

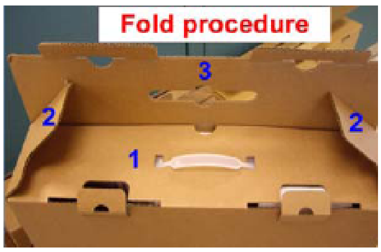


5.4. Packing

The sequence of the accessory decided by factory

P/N	Region	(A) Outside	(B) Inside
xxC	China	3 years guarantee card 三包卡 with LBL	Certificate card
xxE	EU	x	Service Information Safety Instruction
xxA	US,CA	x	US warranty card BQL warranty card Brazil warranty card
xxR	Argentina	x	BQL warranty card Brazil warranty card
xxK, xxW, xxP, xxM, xxN, xxS, xxI	BQP	x	BQP online warranty card
xxJ/ xx7	Japan	x	JP warranty card
xxT	Taiwan	x	TW warranty card
xxL	Mexico	x	BQL warranty card Brazil warranty card
xxH	HK		BQhk warranty card Certificate card





5.5. Block diagram

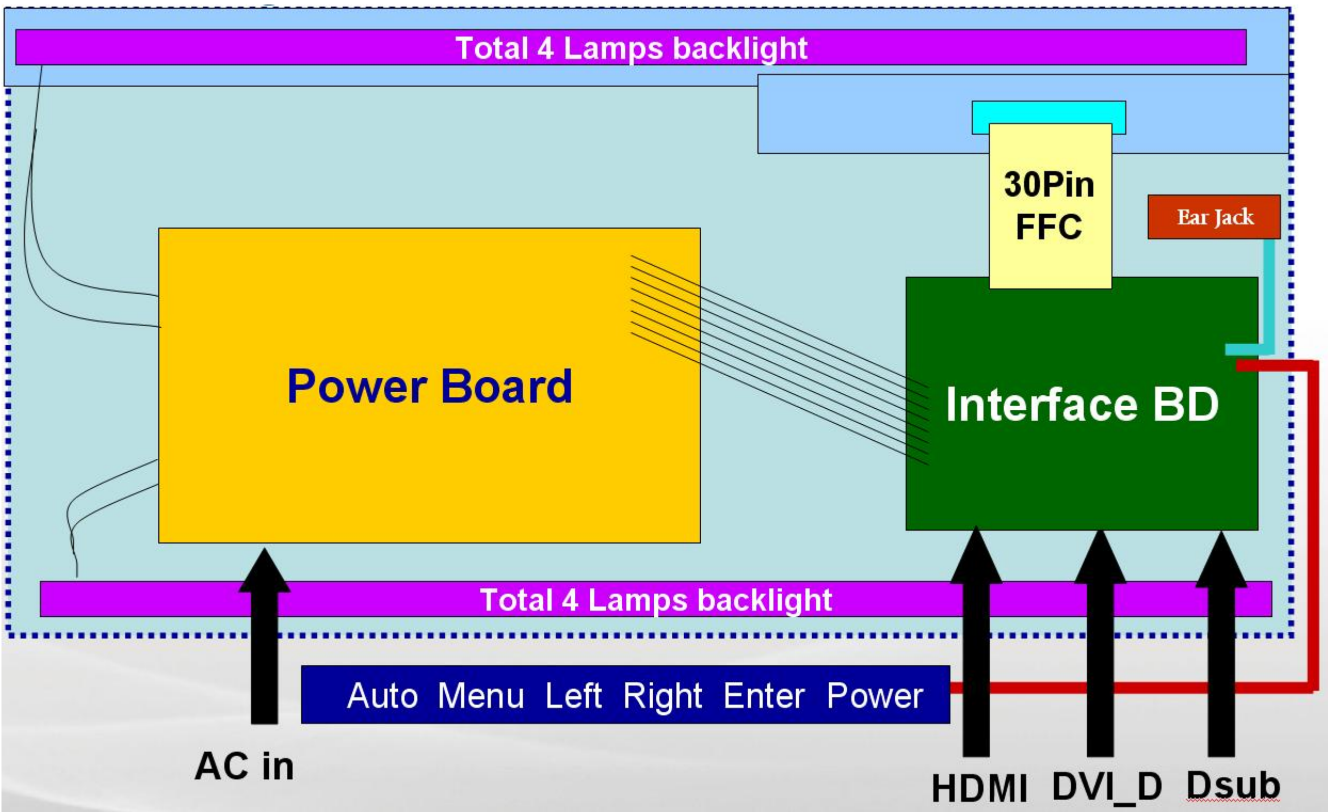
The G2420HD is a 24" (1920x1080) Model, LCD type is TN+ Film and Normally White, 16.7M colors(R, G, B 6-bit data+ FRC data) TFT LCD monitor. There are D-SUB, DVI and HDMI interface LCD monitor. It's compliant with VESA specification to offer a smart power management and power saving function. It also offers OSD menu for users to control the adjustable items and get some information about this monitor. The best function is to offer users an easy method to do DDC/CI Enable and Auto Adjustment items well done just by pressing hot key, we called it "DDC/CI" and "Auto" which can manual controlled items.

G2420HD also offer DDC2/CI function to meet VESA standard.

The G2420HD consists of a LCD module with 4 lamps, a power board including an inverter, a control board, a Interface board. The block diagram is shown as below.

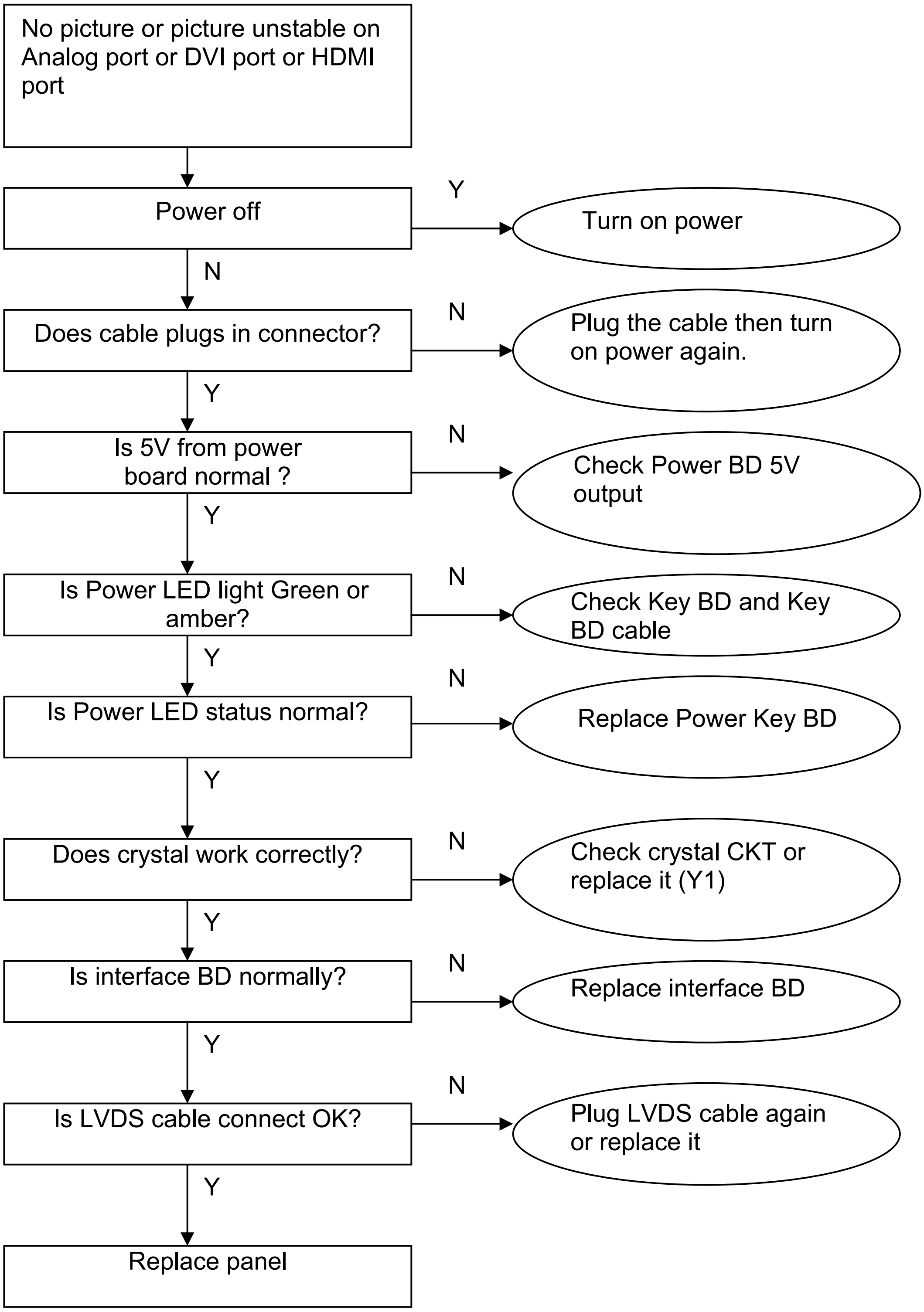
Monitor internal structure

Monitor internal structure

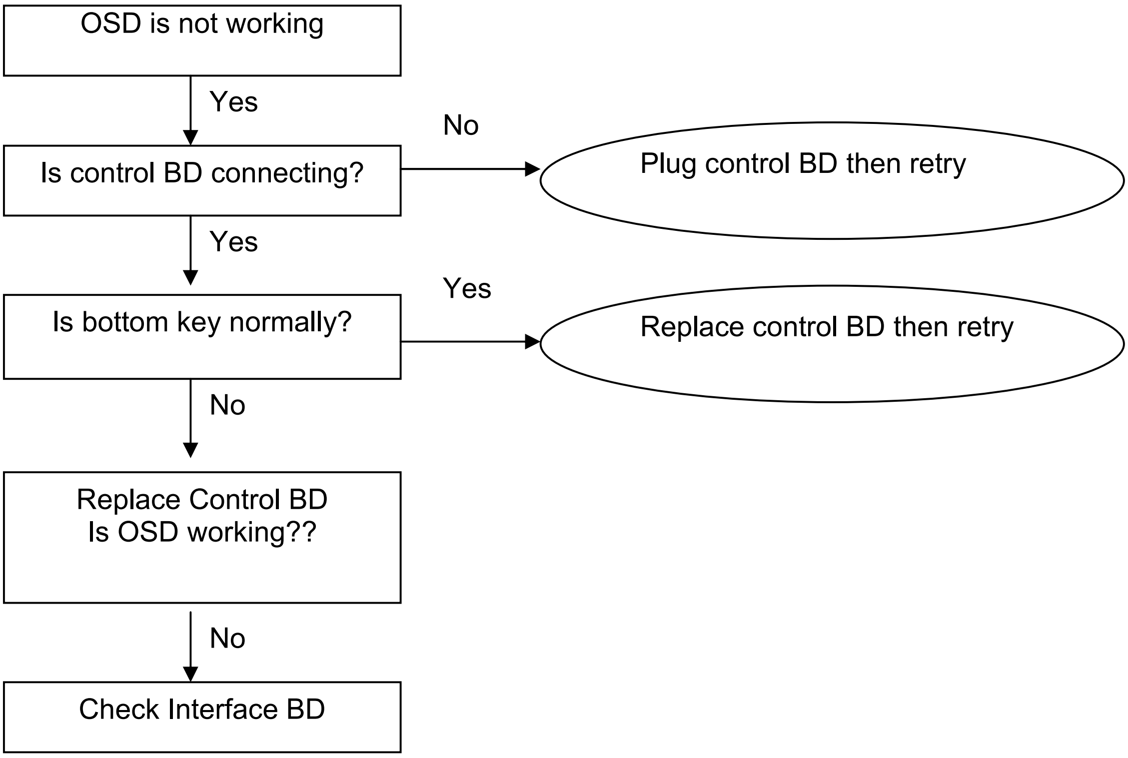


5.6. Trouble Shooting Guide

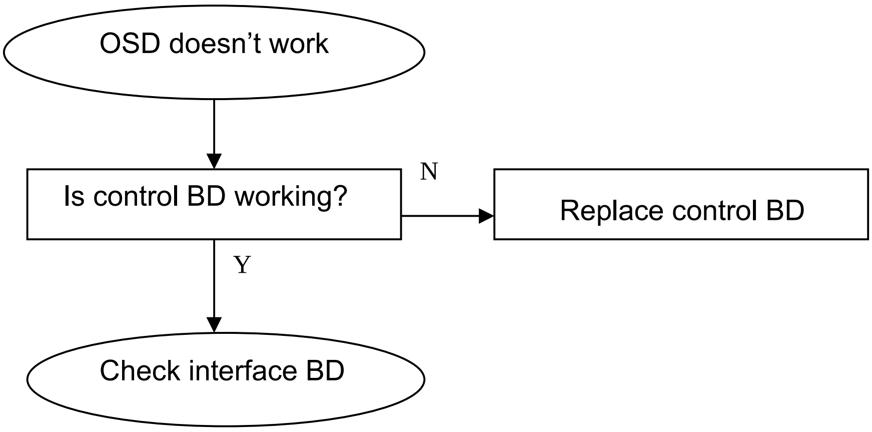
5.6.1 No Display or display is unstable on analog, digital or video port:



5.6.2 BUTTON Function:

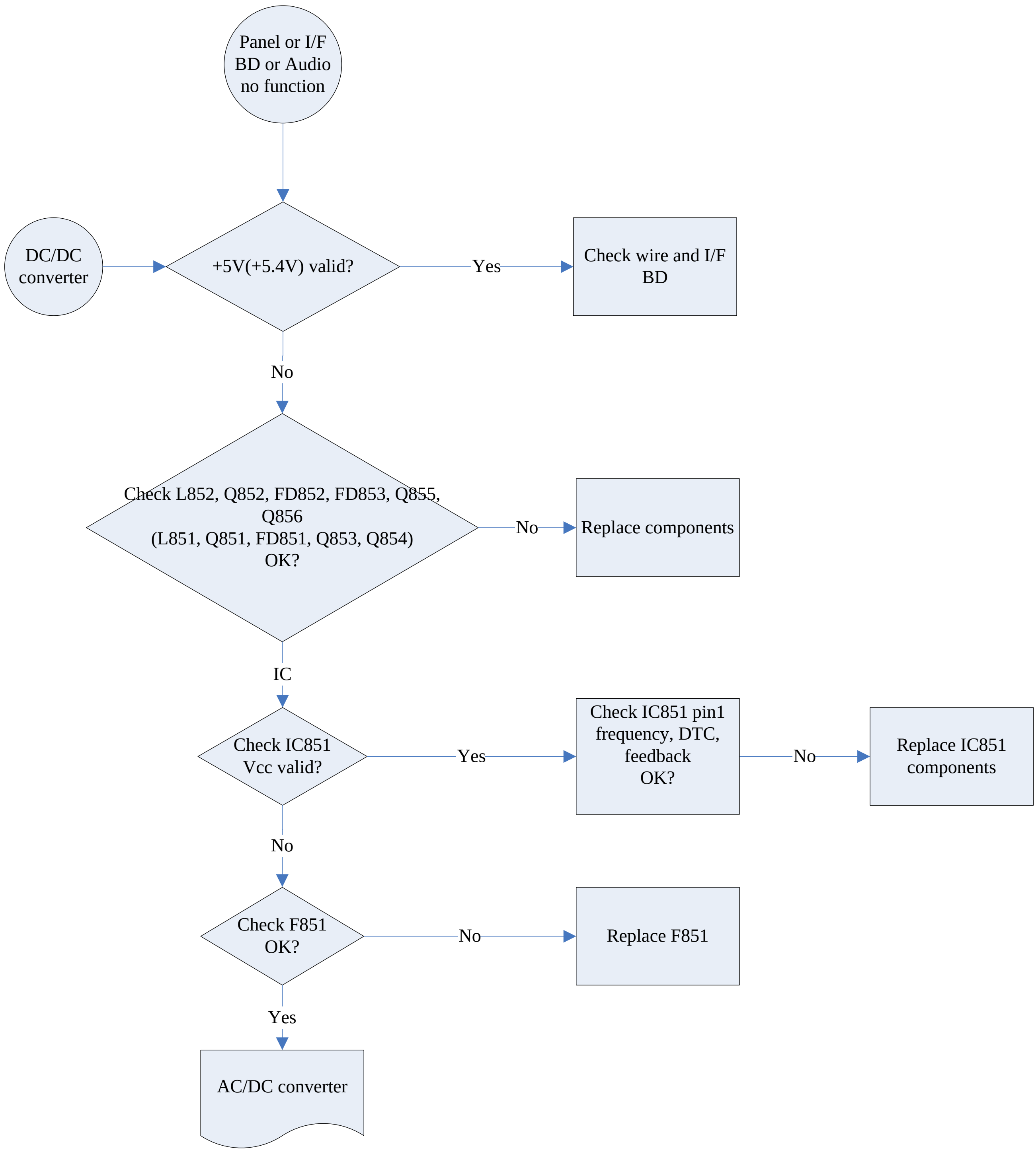


5.6.3 OSD Function:

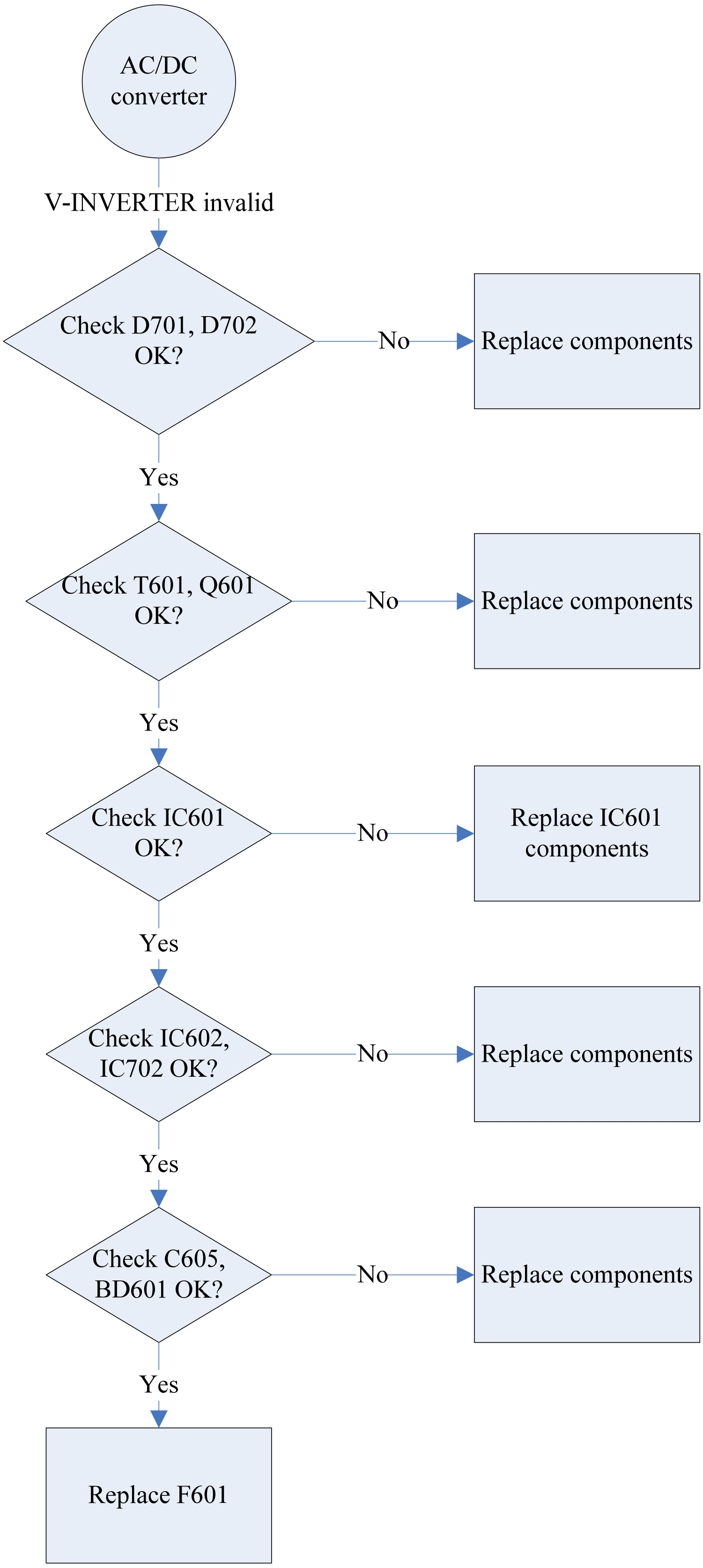


5.6.4 Power no work troubleshooting

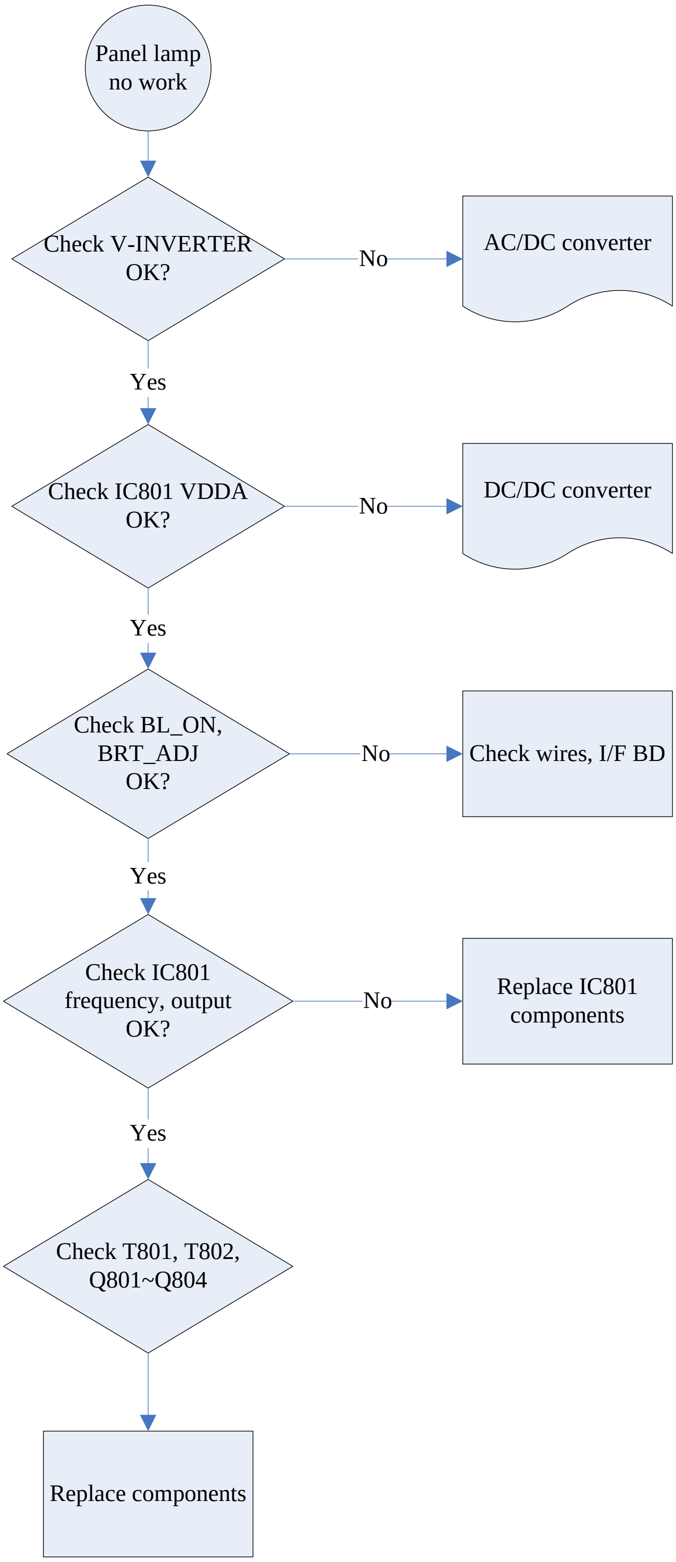
5.6.4.1 DC/DC converter



5.6.4.2 AC/DC converter

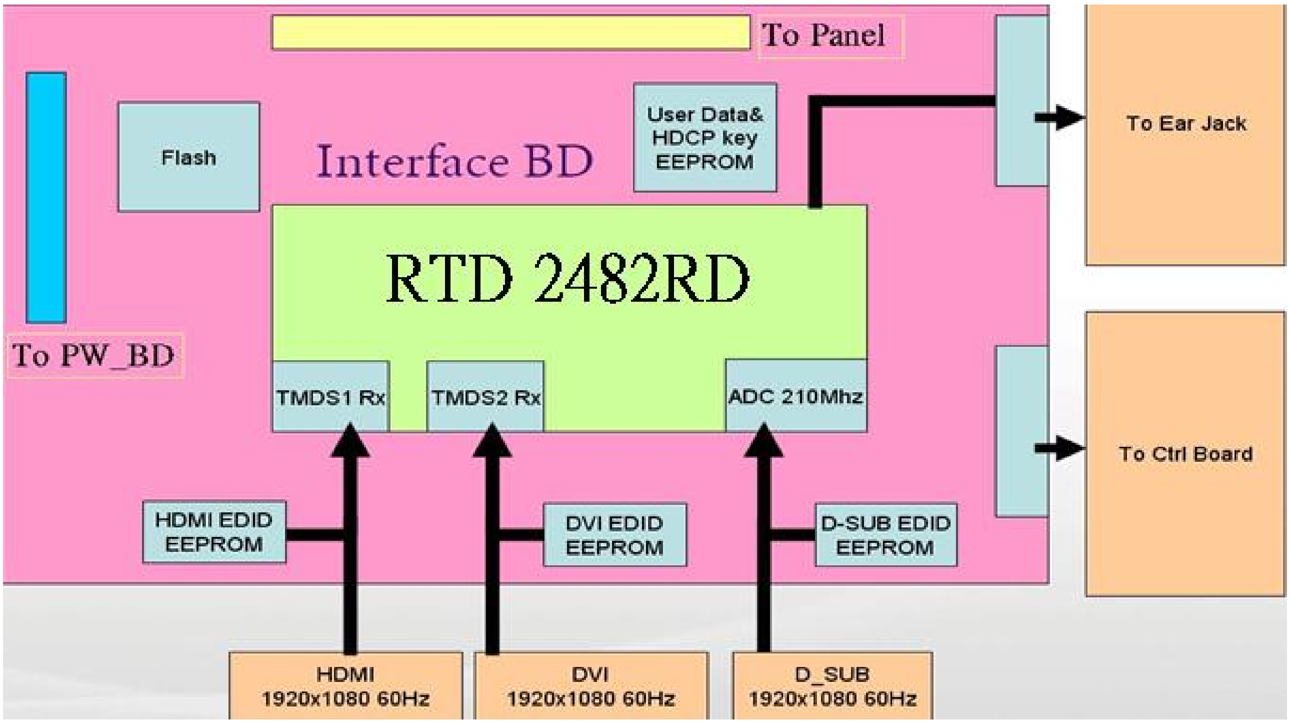


5.6.4.3 Inverter



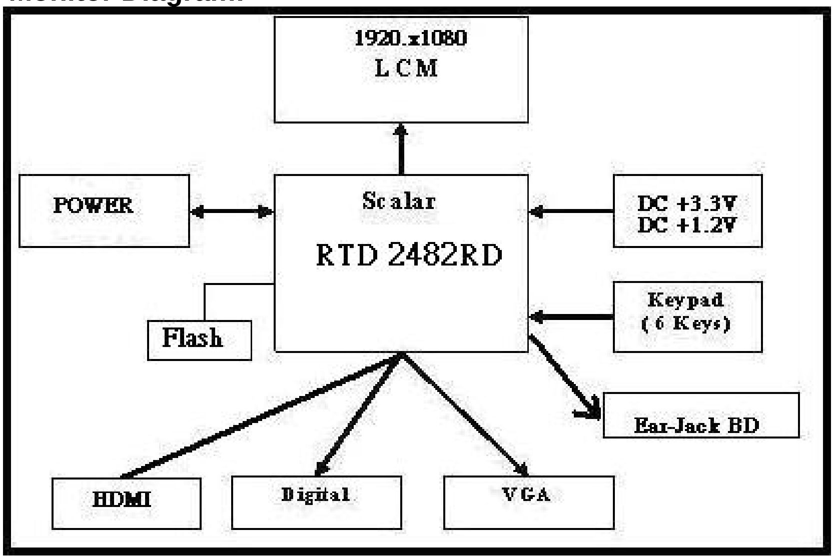
5.7. Circuit Operation Theory

A-1.) Interface board diagram:



A-2.) Circuit operation theory:

(a) Monitor Diagram:



(b) Circuit operation theory

A basic operation theory for this interface board is to convert analog signals of Red, Green and Blue to digital signals of Red, Green and Blue. The scaling IC has internal A/D converter, internal OSD, built in RSDS transmitter and auto-detect input timing functions. A/D converter is convert analog signal to digital data. OSD is offering adjustable functions to end-user. Detect timing is for detect change mode. RSDS transmitter is used to compress the digital RGB data, the Hsync, Vsync and pixel clock generated by Scaling then output to LCD module. Flash-rom stores source code and MCU (embedded in Scalar) offers H/W DDC2Bi function & controls system processing. EEPROM is stored DDC data, OSD common data and user mode data.

(c) IC introduction:

1.) DDC (Display Data Channel) function: We use DDC IC to support DDC2Bi function. DDC data is store in 24C02 (EEPROM). Those data related to LCD monitor specification. PC can read them by “SDA” and “SCL” serial communication for I^2C communication for DDC2Bi.

2.) Scalar IC: There are A/D, TMDS receiver, Scaling, OSD and LVDS transmitter functions built-in the RTD2482D IC. Scaling IC is revolutionary scaling and color engine, capable of expanding any source resolution to a highly uniform and sharp image or down scaling from 1920x1080, combined with the critically proven integrated 8 bit triple-ADC and patented Rapid-lock digital clock recovery system. It also support detect mode and DPMS control.

3.) MCU embedded in Scalar: Control unit, it controls all the functions of this interface board, just like the OSD display setting, the adjustable items, adjusted data storage, the external IIC communication, support DDC2Bi. .

4.) EEPROM: We use 24C16 to store all the adjustable data, user settings and uses two 24C02 to store D-SUB, DVI and HDMI data.

5.) Flash-rom stores source code.

A-2.) Control board introduction

There are 6 keys for user's control which includes “Power”, “Menu”, “Right/Plus”, “Left/Minus”, “Auto”, and “Enter”. The following descriptions are the introduction of these keys.

(1) Power key: to turn/off power of monitor

(2) “Menu” key: to enter sub-menus or select items.

(3) “Right/Plus key: to select previous and to increase adjustment and Brightness /Contrast Popup submenu hotkey

(4) “Left/Minus” key: to select next and to decrease adjustment and Senseye Mode Popup submenu hotkey

(5) “Auto” key: to perform auto adjustment

(6) LED: It indicates the DPMS status of this LCD monitor; blue light means DPMS on (Normal operating condition). Amber light means DPMS off (Power Saving).

A-3.) Power board diagram:

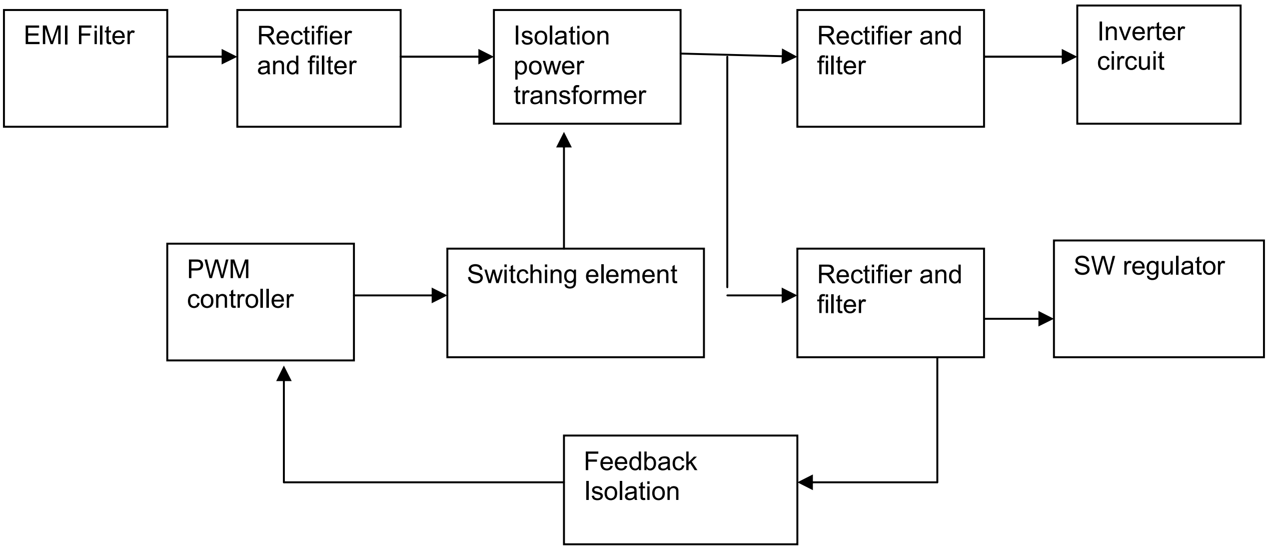


Fig.1

#1 EMI Filter

This circuit (fig. 2) is designed to inhibit electrical and magnetic interference for meeting FCC, VDE, VCCI standard requirements.

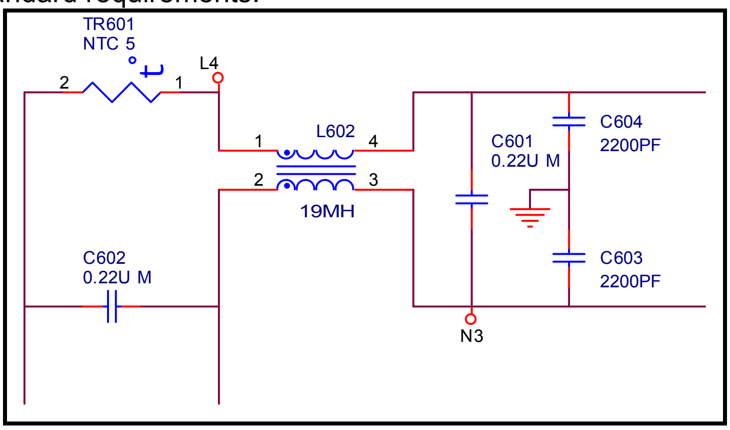


Fig. 2

#2 Rectifier and filter

AC Voltage (90-264V) is rectified and filtered by BD601, C605 (See Fig 3) and the DC Output voltage is 1.4*(AC input). (See Fig.3)

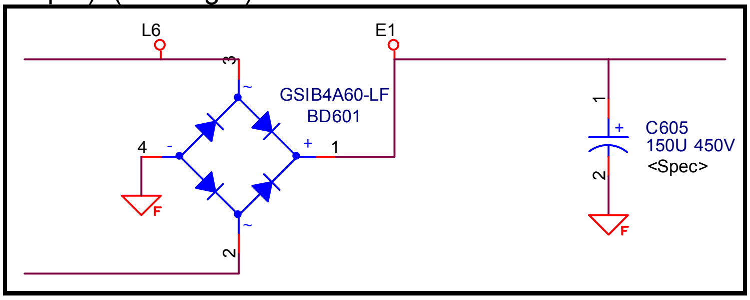


Fig. 3

#3 Switching element and Isolation power transformer

When the Q601 turns on, energy is stored in the transformer. During Q601 turn-off period, the stored energy is delivered to the secondary of transformer. C614, R607, C607 and D601 are snubber circuits. R615 is current sense resistor to control output power. (See Fig.4)

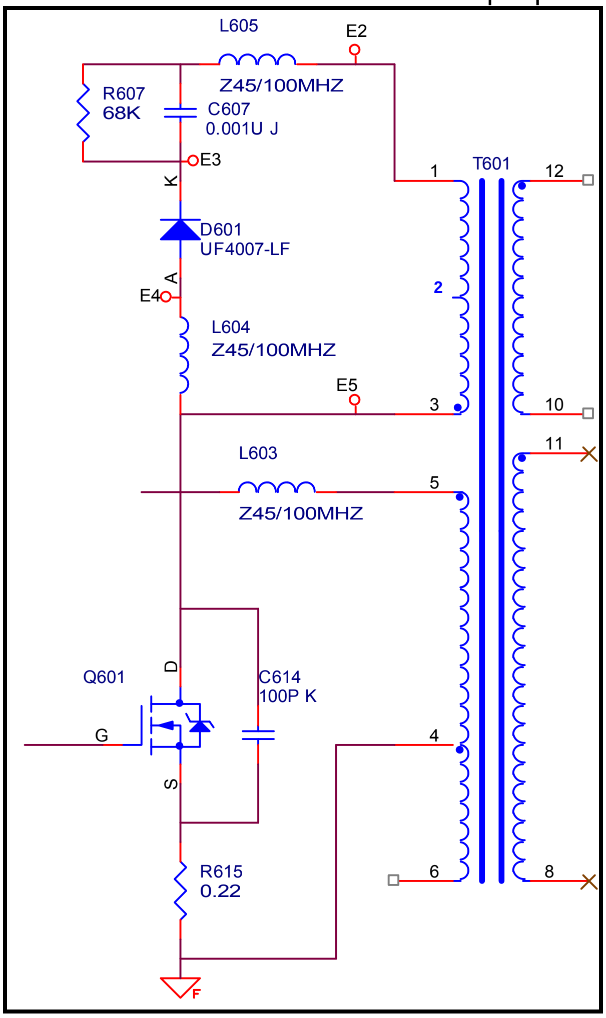


Fig. 4

#4 Rectifier and filter

D701, D702, C701, C702, C703 are used to produce DC output. (See Fig.5)

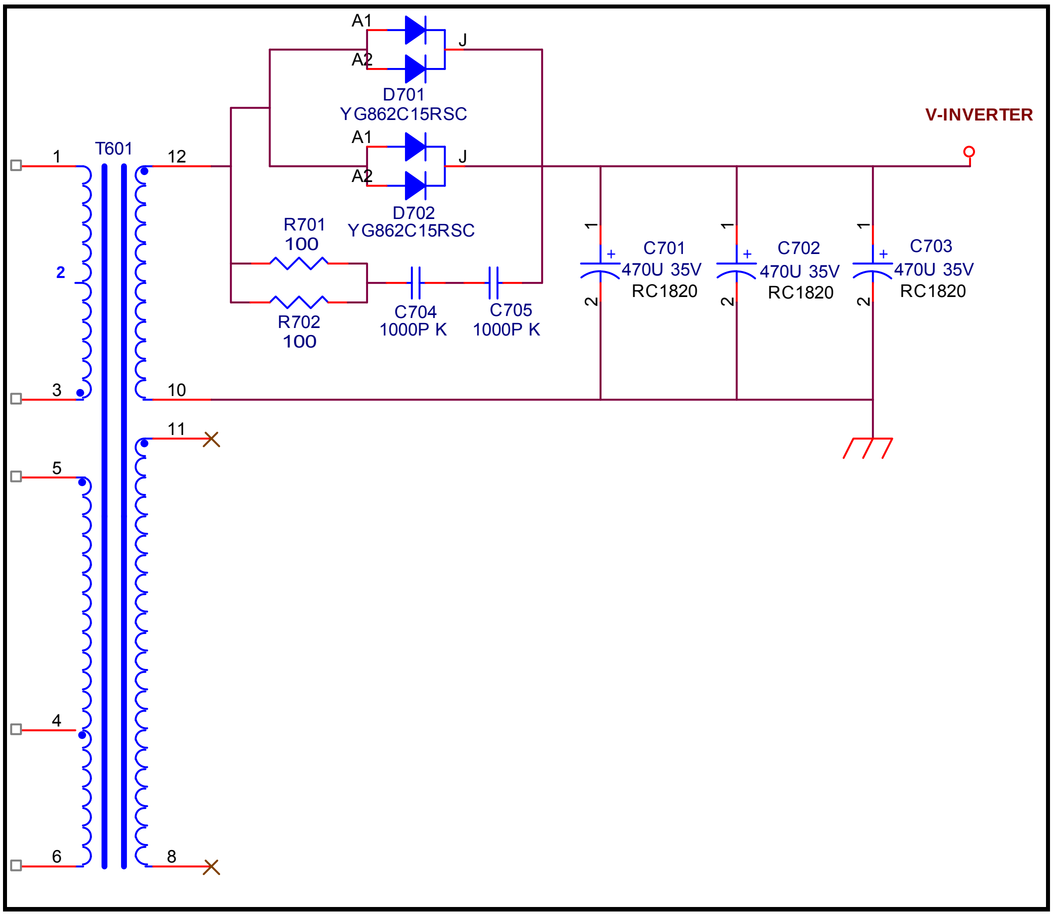


Fig. 5

#5 PWM Controller

The TEA1530(A)T can be used in Fixed Frequency converter designs for low voltage, high current applications. At low power (standby) levels, the system operates in cycle skipping mode which minimizes the switching losses during standby.

The proprietary high voltage BCD800 process makes direct start-up possible from the rectified universal mains voltage in an effective and green way. A second low voltage BICMOS IC is used for accurate, high speed protection functions and control.

The TEA1530(A)T enables highly efficient and reliable supplies to be designed easily.

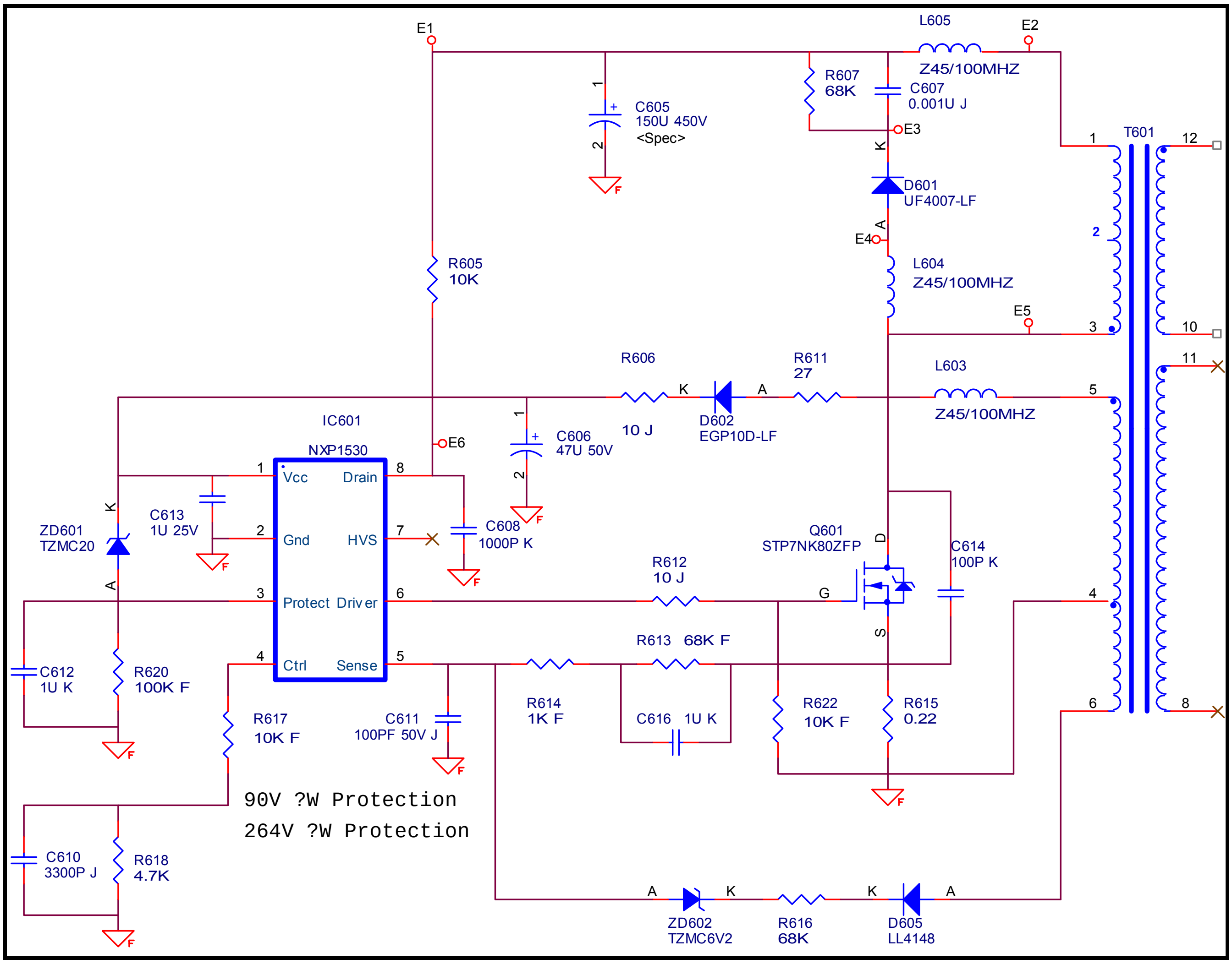


Fig. 6

#6 Feedback circuit

PC123 is a photo-coupler and KA431 is a shunt regulation. They are used to detect the output voltage change and be the primary and secondary isolation. When output voltage changes, the feedback voltage will be compared and duty cycle will be decided to control the correct output voltage. (See Fig.7)

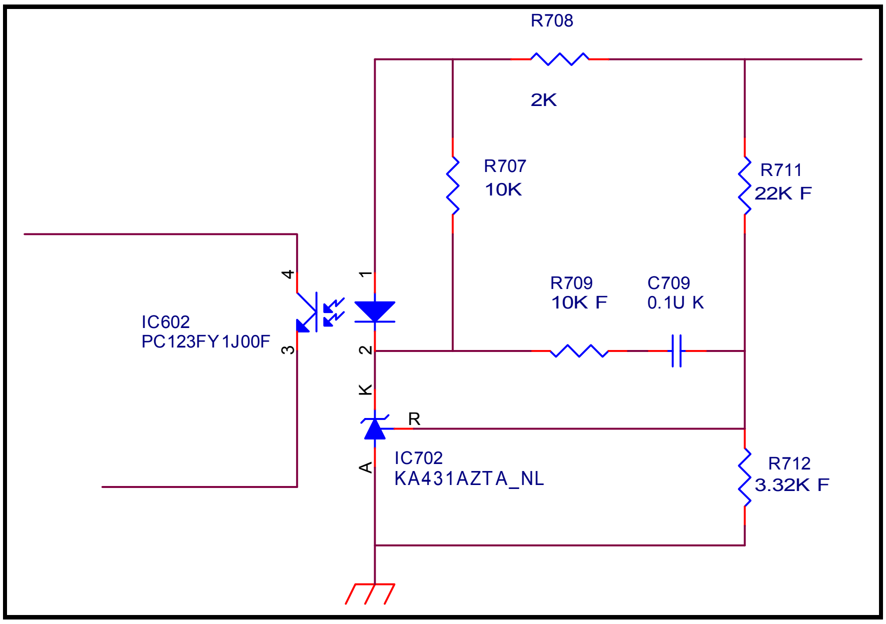
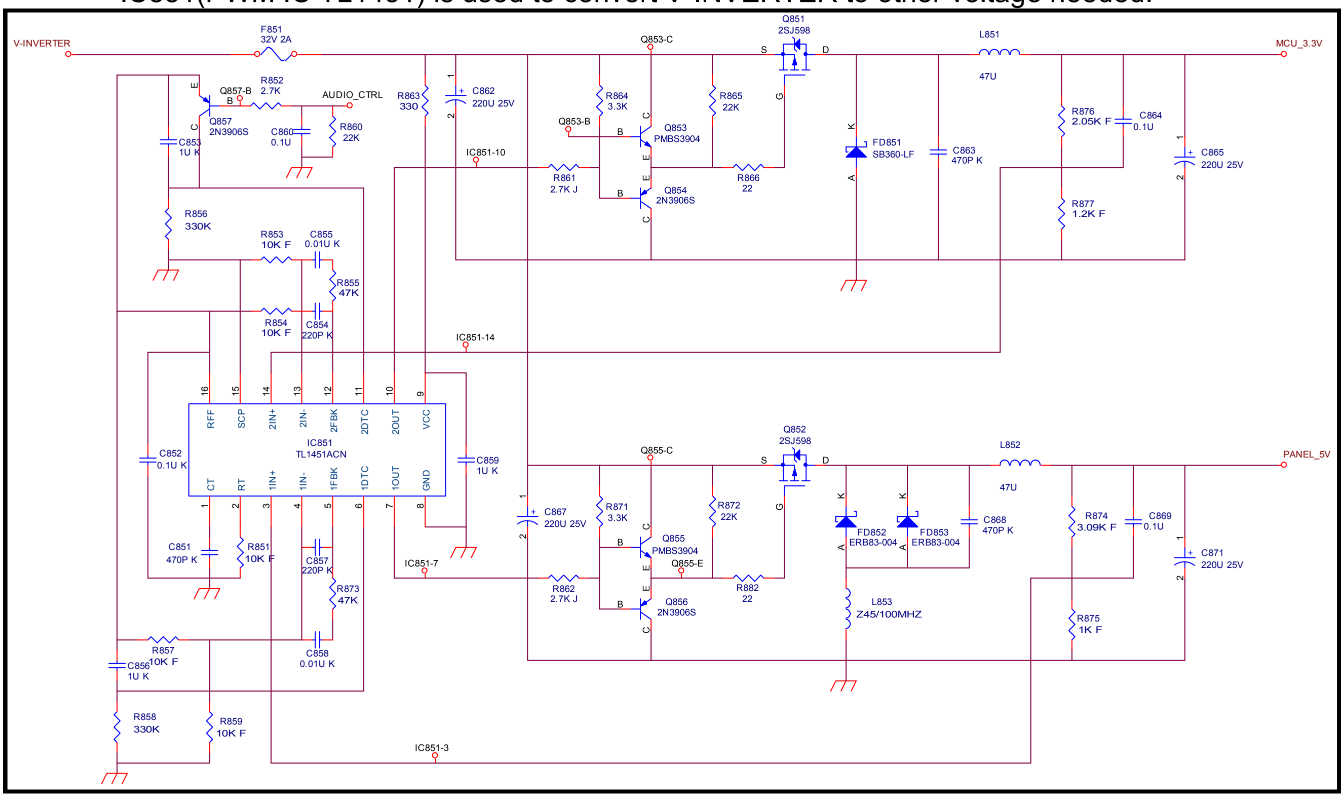


Fig. 7

#7 DC-DC circuit

IC851(PWM IC TL1451) is used to convert V-INVERTER to other voltage needed.



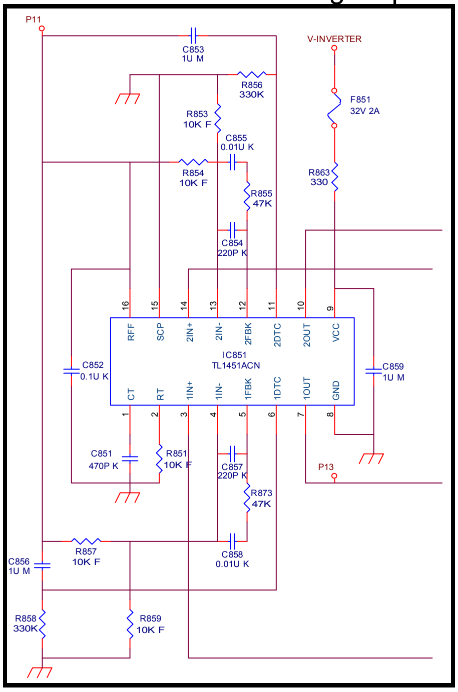
IC851(TL1451) is a 2-way PWM control IC.

C851/R851 determine the frequency of PWM.

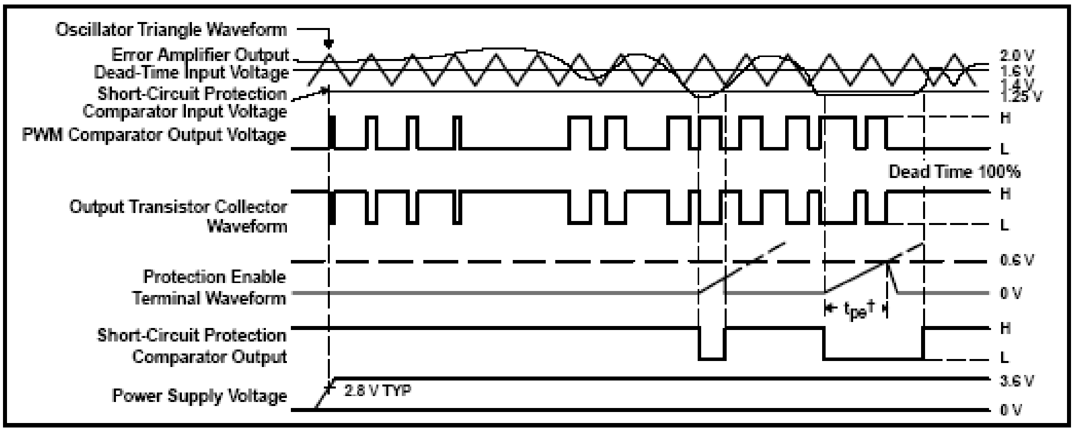
Pin 1IN+/1IN- and 2IN+/2IN- are the inputs of the error amplifiers. 1IN+/2IN+ are used as the feedback pins for DC-DC circuit.

1DTC/2DTC are used for determining the threshold states of dead time control.

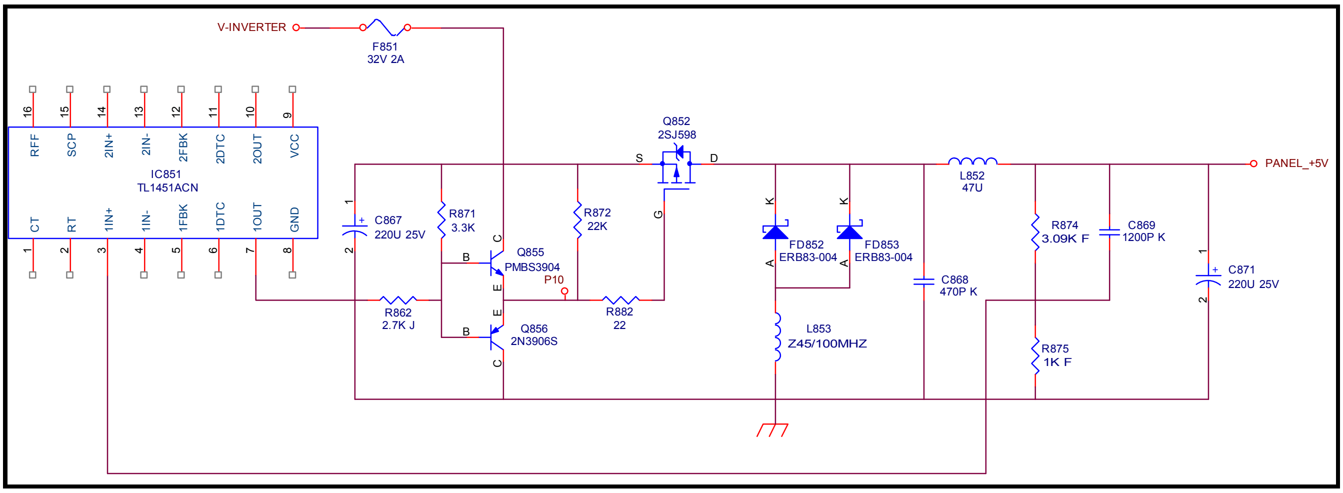
C854, C855, C857, C858, R855 and R873 are used for gain/phase compensation.



The timing diagram of TL1451 is shown as following:



P-MOSFET Q852 is used for switching of step-down converter. And FD852/FD853 are the flywheel diodes.
R874/R875 determine the feedback to IC851 to set up the output to +5V or +3.3V.



#8 Inverter Circuit Operation Theory

LCDM Inverter Controller --- OZ9933

OZ9933 is a high performance, cost-effective CCFL controller designed for driving large-size LCD applications requiring 2 to 6 CCFLs.

The controller converts unregulated DC voltages into a nearly sinusoidal lamp voltage and current waveforms.

The OZ9933 supports full-bridge power conversion topologies while maintaining high-efficiency operation, current and voltage regulation, over-voltage and over-current protection, high drive capability.

The control logic provides s regulated ignition voltage and appropriate protection features for over-voltage or over-current conditions.

Pin Assignment of OZ9933

Pin No.	I/O[1]	Names	Description
1	I	VSEN	Voltage Sense Feedback
2	I/O	SSTCMP	Capacitor for Soft-Start and Loop Compensation
3	I/O	CT	Timing Resistor and Capacitor for Operation and Striking Frequency
4	I/O	RT1	Timing Resistor for Striking Frequency
5	---	GNDA	Signal Ground
6	O	PDR2	High Side Driver Output 2
7	---	GNDP	Power Ground
8	O	NDR2	Low Side Driver Output 2
9	O	NDR1	Low Side Driver Output 1
10	O	PDR1	High Side Driver Output 1
11	---	VDDA	Input Power Pin
12	I/O	TIMER	Timing Capacitor for Delay Timer
13	I	PWM	External PWM Dimming Input
14	I	ISEN	Current Sense Feedback
15	I	OVPT	Over-Voltage Protection Threshold Voltage
16	I	ENA	IC Enable/Disable

I/O[1]: I=input, O=output, I/O=input/output

Full-Bridge Configuration

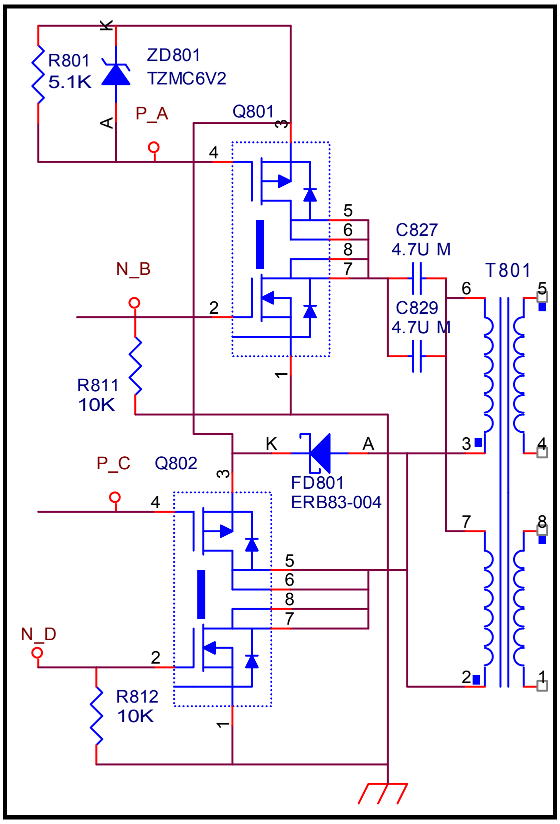


Fig. 1

Fig. 1: Q801, Q802 and T801 form a full-bridge configuration.

The full-bridge switch is configured such that Q801 N-MOS and Q8026 P-MOS are ON while Q801 P-MOS and Q802 N-MOS are OFF in a half-cycle. During the next half cycle, Q801 N-MOS and Q802 P-MOS are OFF while Q801 P-MOS and Q802 N-MOS are ON. This develops an alternating current through the transformer primary.

The result in T801 primary coil has an AC square waveform.
Certainly, the secondary of T801 will produce high voltage AC sinusoidal waveform.

Feed-back Circuit

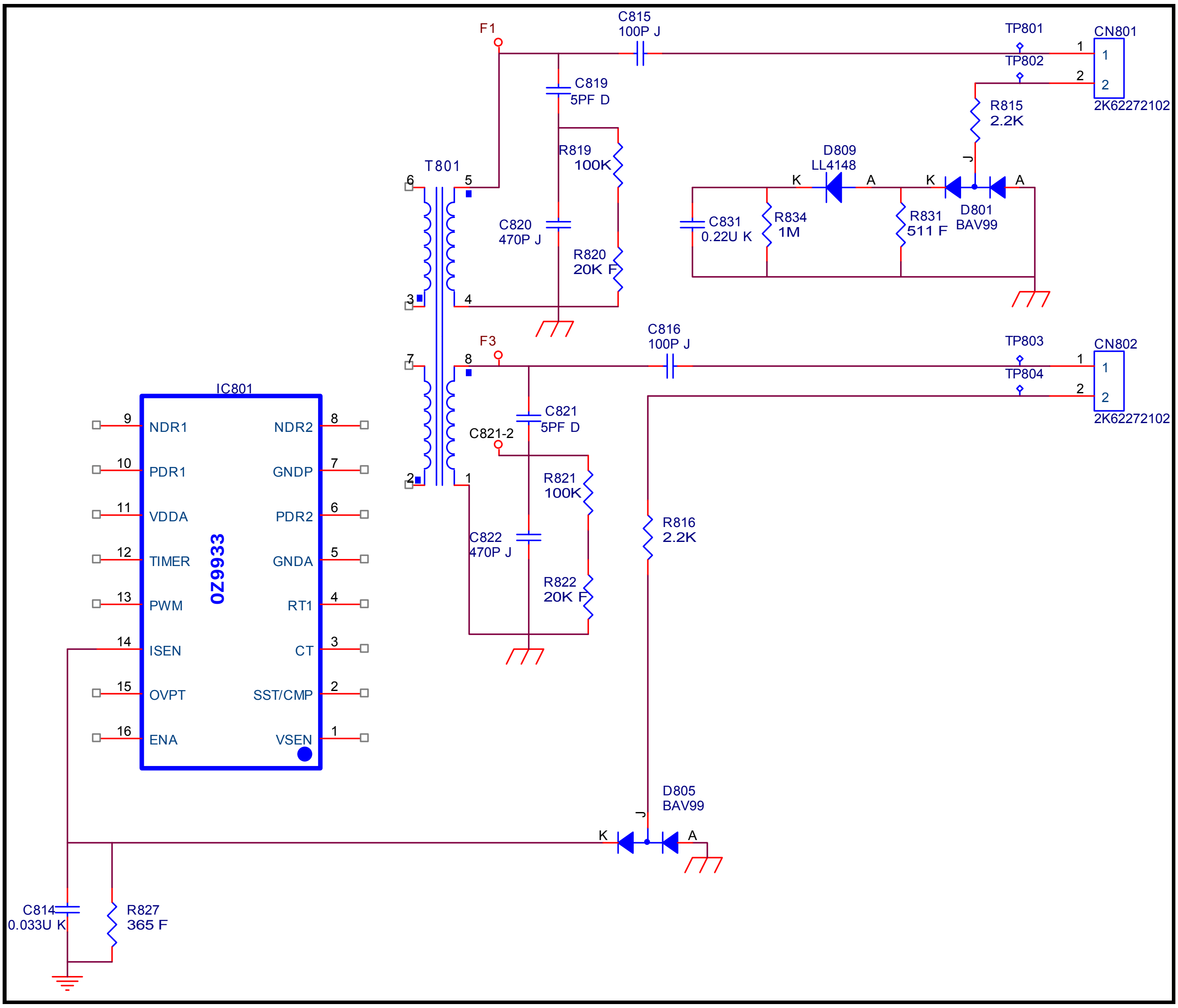


Fig. 2

Fig. 2 shows the feedback circuit consists of a lamp, R816, D805, R827 and C814.

With the lamp current through D805, a half sine-waveform voltage signal is produced.

We may get the Maximum value through R827/C814.

After OZ9933 gets the feedback voltage signal from PIN14, the duty of the full-bridge driver outputs is decided.

Appendix 1 – Screw List / Torque

STANDARD SCREW TORQUE SPEC.

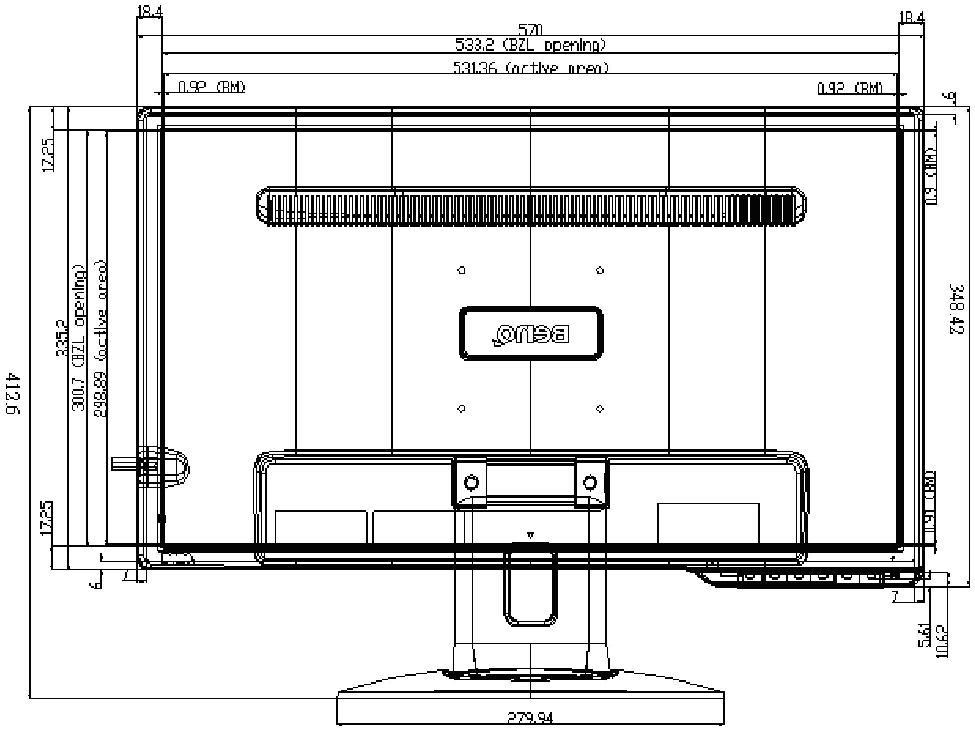
ITEM	P/N	DESCRIPTION	MOUNTING MATERIAL	TORQUE (KG-CM)	HOLE SIZE (MM)	Screw Head
1	8F.205B4.019	SCRW MACH HEX #4-40*0.3" N	Metal; D-SUB;DVI Connector	5.0±0.6	5.0±0.6	#4-40
2	8F.5A224.6R0	SCRW MACH FLATM3*0.5P*6L ZN	Metal Metal to metal Plastic to metal	Side mount: 3±0.6 Other: 4±0.6	M3*0.5	#2
3	8F.EA324.6R0	SCRW TAP FH M3*6L ZN	Metal	None tread： 8～10 Have tread: 6～8	Φ2.68±0.03	#2
4	8F.5A356.8R0	SCRW MACH FH M4*8L B-ZN NYL	Metal Metal to metal Plastic to metal	9.0±1.0	M4*0.7	#2
5	6K.L8810.001	ASSY SCREW M4*8L FP726A NLK ISU (8F.5A456.8R0+4B.L7212.001)	Metal Metal to metal Plastic to metal	9.0±1.0	M4*0.7	#2
6	8F.00273.6R0	SCRW TAP PH F/10WSH M3*6L C-ZN	Metal Metal to metal Plastic to metal PCB to metal	None tread： 8～10 Have tread: 6～8 Aluminum: 4~5	Æ2.68±0.03	#2
7	8F.VZ524.6R0	SCRW TAP FLAT+EXT M3*6L C-ZN	Metal Metal to metal	None tread： 8～10 Have tread: 6～8 Aluminum: 4~5	Æ2.68±0.03	#2
8	8F.00518.100	SCRW TAP W/FL M3*10L(S3.8)ZN	Metal Metal to metal Plastic to metal SPEAKER to metal	None tread： 8～10 Have tread: 6～8 Aluminum: 4~5	Æ2.68±0.03	#2
9	8F.00003.143	SCRW TAP PAN #4-40*3/8	Aluminum (Heatsink)	3.3±0.3	Φ2.6±0.03	#2

10	8F.VG234.6R0	SCRW TAP PH W/F M3*6 TP-S ZN	Aluminum (Heatsink)	None tread： 8～10 Have tread: 6～8 Aluminum: 4~5	Φ2.68±0.03	#2
11	8F.VZ526.6R0	SCRW TAP FLAT+EXT M4*6L ZN-W	Metal Metal to metal	10±1.0	M4*0.7	#2
12	8F.HA334.8R0	SCRW TAP FPHM3*6(6/1)TP-S B-ZN	Metal Metal to metal Plastic to metal	6~8	Φ2.68±0.03	#2
13	8F.5A456.8R0	SCRW MACH FLAT M4*8L C-ZN NYLO	Metal Metal to metal Plastic to metal	9.0±1.0	M4*0.7	#2
14	8F.WA324.6R0	SCRW TAP CAP M3*1.34P*6L B-NI	Metal Metal to metal Plastic to metal	5.0±1.0	Φ2.35±0.05	#2
15	8F.XA324.5R0	SCRW TAP M3*5L B-ZB	Metal Metal to Plastic	6~8	2.85~2.95	#2
16	8F.1A526.5R0	SCRW MACH PAN M4*5L NI	Metal Metal to metal Plastic to metal	8~10	M4*0.7P	#2
17	8F.1B524.3R0	SCRW MACH PAN W/SPG M3*3L NI	Metal Metal to metal Plastic to metal	6~8	M3*0.5P	#2
18	8F.5A524.4R0	SCRW MACH FLAT M3*4L NI(W2407 lift	Metal Metal to metal Plastic to metal	6~8	M3*0.5P	#2
19	8F.00573.5R0	SCRW TAP FPHM3*5 B-ZN	Metal Metal to Plastic	6~8	M3*0.5P	#1
20	8F.5A456.7R0	SCRW MACH FLAT M4*7L B-ZN NYL	Metal Metal to Metal Plastic to Metal	8~10	M4*0.7P	#2
21	8F.XA326.150	SCRW TAP FLAT M4*15L B-ZN	Metal Metal to metal Plastic to metal	8~10	M4*0.7P	#2

22	8F.00608.6R0	SCRW TAP PH F/10WSH M3*6L B-ZN	PLASTIC	4.5±0.5	Φ2.35±0.05	#2
23	8F.XA313.8R0	SCRW TAP FLAT/PT M2.5*8L B-ZN	Plastic Metal to plastic Plastic to plastic PCB to plastic	4.0±0.5	Φ2.0±0.05	#1
24	8F.WA314.8R0	SCRW TAP CAP M3*1.34P*8L B-ZN	Plastic Metal to plastic Plastic to plastic	5.0±1.0	Φ2.35±0.05	#2
25	8F.XA224.6R0	SCRW TAP FH M3*6L ZN	PLASTIC	4.5±0.5	Φ2.35±0.05	#2
26	8F.XA314.8R0	SCRW TAP FLAT M3*1.34P*8L B-ZN	Plastic Metal to plastic Plastic to plastic	4.5±0.5	Φ2.35±0.05	#2
27	8F.00607.8R0	SCRW TAP FPH M3*8L(5/0.8) B-ZN	Plastic Metal to plastic Plastic to plastic PCB to plastic	4.0±0.5	Φ2.68±0.03	#2
28	8F.5A322.2R4	SCRW MACH FLAT-P M2*2.4L B-ZN	Plastic Metal to plastic Plastic to plastic PCB to plastic	2.0±0.5	Φ1.75±0.05	#1
29	8F.00551.3R0	SCRW M FPH M2*3L (6/1.4) NI	Plastic Metal to plastic Plastic to plastic PCB to plastic	2.0±0.5	Φ1.75±0.05	#1
30	8F.MA324.5R5	SCRW TAP FPH M3*5.5L B-ZN	Metal Metal to metal Plastic to metal	6~8	M3*0.5P	#2
31	8F.XA326.100	SCRW TAP FLAT M4*10L B-ZN	Plastic Metal to plastic Plastic to plastic	8~10	Φ3.45±0.05	#2

Appendix 2-Physical Dimension Front View and Side view

Fig. 1 Physical Dimension Front View and Side view



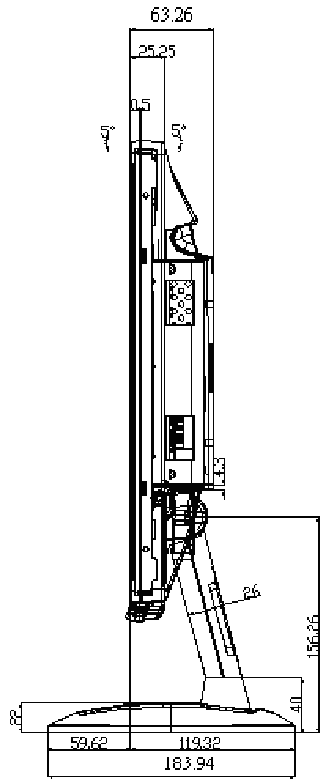


Fig. 2 Appearance Description

